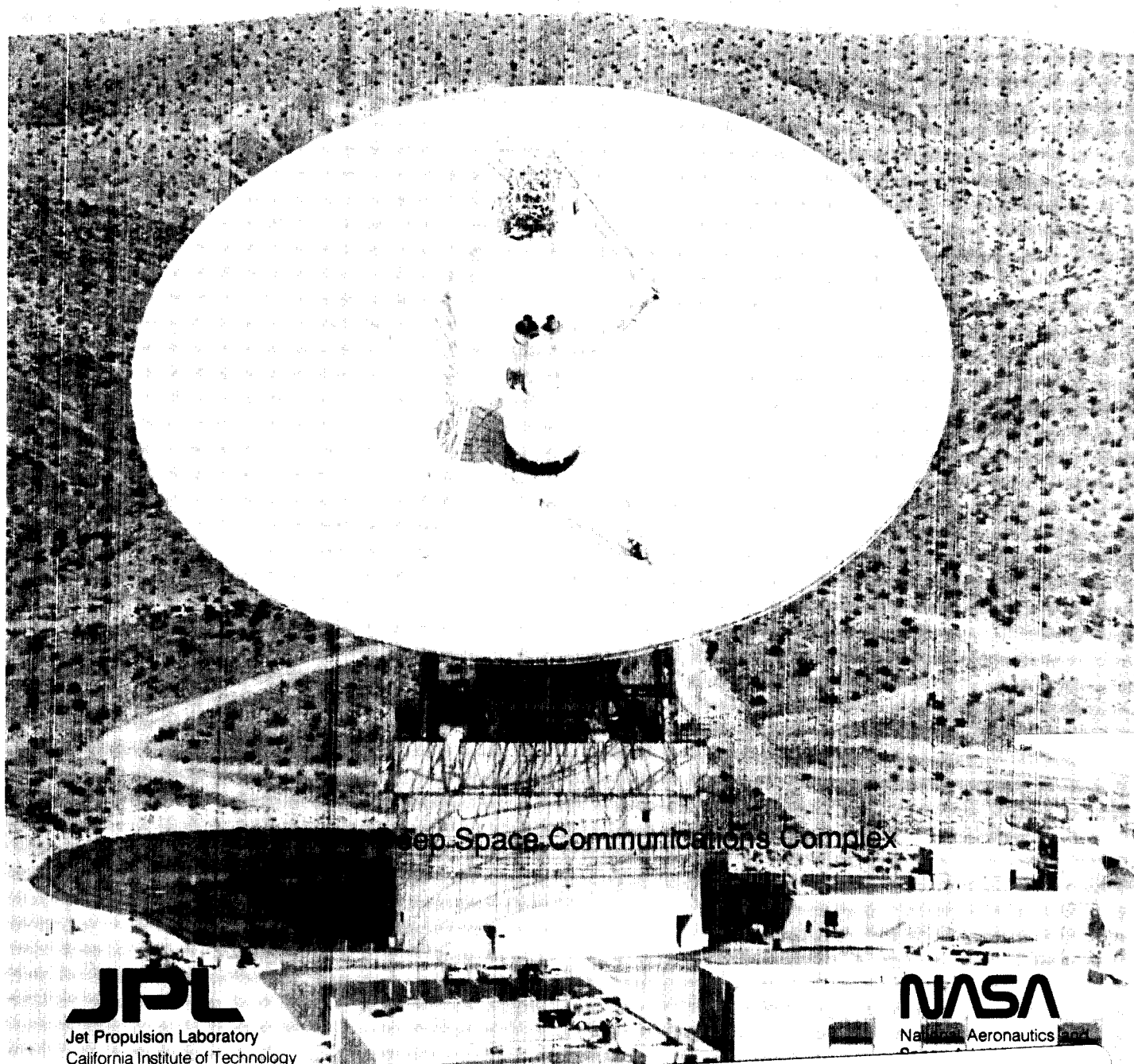


Environmental Projects: Volume 9

Construction of Hazardous Materials Storage Facilities



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Environmental Projects: Volume 9

Construction of Hazardous Materials Storage Facilities

Goldstone Deep Space Communications Complex

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ABSTRACT

The Goldstone Deep Space Communications Complex (GDSCC), located in the Mojave Desert about 40 miles north of Barstow, California, and about 160 miles northeast of Pasadena, is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network, one of the world's largest and most sensitive scientific telecommunications and radio navigation networks. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California. A detailed description of the GDSCC is presented in Section II of this report.

Activities at the GDSCC are carried out in support of seven parabolic dish antennas. These activities may give rise to environmental hazards: use of hazardous chemicals, asbestos, and underground storage tanks as well as the generation of hazardous wastes. Federal, state, and local laws governing the management of hazardous substances, asbestos, and underground storage tanks have become so complex there is a need to devise specific programs to comply with the many regulations that implement these laws.

In support of the national goal of the preservation of the environment and the protection of human health and safety, NASA, JPL and the GDSCC have adopted a position that their operating installations shall maintain a high level of compliance with these laws.

Some hazardous materials, including various oils, kerosene, chlorinated solvents, and acids, are used in day-to-day operations at the GDSCC. Thus, as defined in the California Administrative Code, the GDSCC is a generator of hazardous wastes.

In 1986, in an environmental audit carried out by M. B. Gilbert Associates, Long Beach, California, one of the environmental problems uncovered at the GDSCC involved substandard, environmentally unacceptable storage sites for hazardous materials and wastes.

In 1987, Engineering Science, Inc., Pasadena, California, carried out field studies of any possible subsurface contamination that may have been caused by the leakage and seepage of improperly stored hazardous materials and wastes.

Engineering-Science, Inc. then was retained by JPL to prepare a Preliminary Engineering Report indicating how best to replace the then existing, environmentally substandard storage areas for hazardous materials and wastes. After consideration of several alternatives, Engineering-Science recommended the construction of four new storage facilities at the GDSCC: one each at Echo Site, Venus Site, Mars Site and Apollo Site. In addition, it was recommended that a new, acid-wash facility also be constructed at Venus Site.

An Environmental Assessment Report, prepared by Engineering-Science in 1988, concluded that the construction of the five new facilities would have no significant impact upon the environment. Engineering-Science then was

retained by JPL as the engineering firm to prepare the Engineering Design Drawings, including calculations and specifications, and to oversee the construction work of the two hazardous materials and wastes storage facilities at Echo and Venus Sites and the one acid-wash facility at Venus Site. The Jenkin Construction Co., Long Beach, California, was awarded the contract to carry out the construction.

This report deals with the work undertaken to construct the two new hazardous materials and wastes storage facilities at Echo and Venus Sites and the acid-wash facility at Venus Site. Construction work began in December 1988 and was completed in May 1989. The two new storage facilities for hazardous materials and wastes and the single acid-wash facility now comply with ordinances dealing with the proper environmental management of hazardous materials and wastes. The two new storage facilities for hazardous materials and wastes at Mars and Apollo Sites are to be completed in 1990.

GLOSSARY

BLM	U.S. Bureau of Land Management
CAC	California Administrative Code
DSCC	Deep Space Communications Complex
DSN	Deep Space Network
DSS	Deep Space Station
EA	Environmental Assessment
E-S	Engineering-Science, Inc., Pasadena, California
FONSI	Finding of No Significant Impact
GCF	Ground Communications Facility
GDSCC	Goldstone Deep Space Communications Complex
HEF	High-Efficiency (Antenna)
JPL	Jet Propulsion Laboratory
MBGA	M.B. Gilbert Associates, Long Beach, California
MTF	Microwave Test Facility
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NOCC	Network Operations Control Center
NTC	National Training Center (U.S. Army)
O&M	Operation and Maintenance
R&D	Research and Development
SF	Square Feet
SPC	Signal Processing Center
STS	Space Transportation System (Space Shuttle)
TDS	Total Dissolved Solids

VOLUME 9

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SECTION I

INTRODUCTION

A. BACKGROUND

The Goldstone Deep Space Communications Complex (GDSCC) is part of the National Aeronautics and Space Administration's (NASA) Deep Space Network (DSN), one of the world's largest and most sensitive scientific telecommunications and radio navigation networks. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California. The primary purpose of the DSN is to support the tracking of both manned and unmanned spacecraft missions and to provide instrumentation for radio and radar astronomy in the exploration of the solar system and universe.

Activities at the GDSCC operate in support of seven parabolic dish antennas at five sites called Deep Space Stations (DSSs): four DSSs are operational in the DSN, while one is devoted to research and development (R&D) activities. There also are four, similar, operational DSSs in Spain and in Australia. Thus, the overall NASA DSN consists of a worldwide network of 12 operational DSSs. An eighth parabolic dish antenna at Goldstone is operated by the National Oceanic and Atmospheric Administration (NOAA). A more detailed description of the GDSCC is presented in Section II.

Operation and maintenance (O&M) of the various sites at the GDSCC involve numerous and diverse activities that could lead to possible environmental problems. Some of these activities include storage, dispensing, transport, use, and disposal of hazardous materials and wastes.

B. DEFINITION OF HAZARDOUS MATERIALS AND WASTES

Hazardous materials are defined as substances that can be harmful to human health, in particular, and to flora and fauna, in general. Such deleterious materials include, for example, substances that may be irritants, corrosives, carcinogens, or toxins. Hazardous materials also include substances that are easily flammable or can generate pressures (explosions) either upon exposure to heat or light, or by undergoing self-decomposition upon standing.

Some hazardous materials, including various oils, kerosene, and chlorinated solvents, are used in day-to-day operations at the GDSCC. This gives rise not only to the problem of how to store these hazardous materials that are necessary to everyday operations, but also to the problem of the continued on-site generation of hazardous wastes. It was reported in 1985 that the GDSCC generated 20 tons of hazardous wastes, including waste oils, cleaning solvents, antifreeze, acids and alkalis, spent batteries, paints, and thinners.

Thus, the GDSCC is not only a user of hazardous materials, but also is a generator of hazardous wastes, as defined in the California Administrative Code (CAC), Title 22.

C. ENVIRONMENTAL AUDIT OF FACILITIES FOR THE STORAGE OF HAZARDOUS MATERIALS AND WASTES AT THE GDSCC

In support of the national goal of the preservation of the environment and the protection of human health and safety, NASA, JPL, and the GDSCC have adopted a position that their operating installations shall maintain a high level of compliance with Federal, state and local laws that govern the management of activities that could be detrimental to the environment and to human health and safety.

Thus, M. B. Gilbert Associates (MBGA), Long Beach, California, was retained by JPL to carry out a comprehensive environmental audit of GDSCC operations and records. This audit, submitted to JPL in May 1986, determined compliance or non-compliance with regulations at the GDSCC with respect to hazardous wastes, solid wastes, air pollution control, wastewater, pesticides, and release of hazardous substances to the environment.

The details of the MBGA audit are recorded in Environmental Projects: Volume 3, Environmental Compliance Audit Final Report, JPL Publication 87-4, September 15, 1987.

One of the environmental shortcomings of the GDSCC, revealed by the MBGA audit, involved the storage of hazardous materials while they were being used, and the storage of hazardous wastes while they awaited disposal. At the time of the audit in May 1986, the existing storage facilities for hazardous materials and wastes did not comply with the new environmental design requirements demanded for such facilities. Examples of the then primitive, substandard, environmentally unacceptable storage areas for hazardous materials and wastes are depicted in Figures 1, 2, 3 and 4 for Mars Site, Apollo Site and Venus Site, respectively. Figure 5 depicts the primitive, substandard acid-wash tanks then in use at Venus Site.

In 1987, Engineering Science, Inc., Pasadena, California, carried out field studies of any possible subsurface contamination that may have been caused by the leakage and seepage of improperly stored hazardous materials and wastes. Details of these studies are described in Environmental Projects: Volume 5, Part One: Study of Subsurface Contamination, JPL Publication 87-4, April 15, 1988.

The then-existing substandard storage facilities, therefore, had to be replaced with facilities that would conform to the various environmental regulations governing their design. Thus, as part of the effort to eliminate the environmental deficiencies uncovered by the MBGA audit, JPL decided to begin with the construction of two new storage facilities for hazardous materials and wastes, one at Echo Site and one at Venus Site. In addition, JPL decided to construct a new acid-wash facility at Venus Site. These would conform to environmental regulations. Similar, new storage facilities are scheduled to be completed at Mars and Apollo Sites in 1990.

D. NEED FOR NEW STORAGE FACILITIES FOR HAZARDOUS MATERIALS AND WASTES AT THE GDSCC

Although the GDSCC is a generator of hazardous wastes, the Complex does not operate any hazardous waste treatment, storage or disposal facilities that require a formal Hazardous Waste Facilities Operating Permit.

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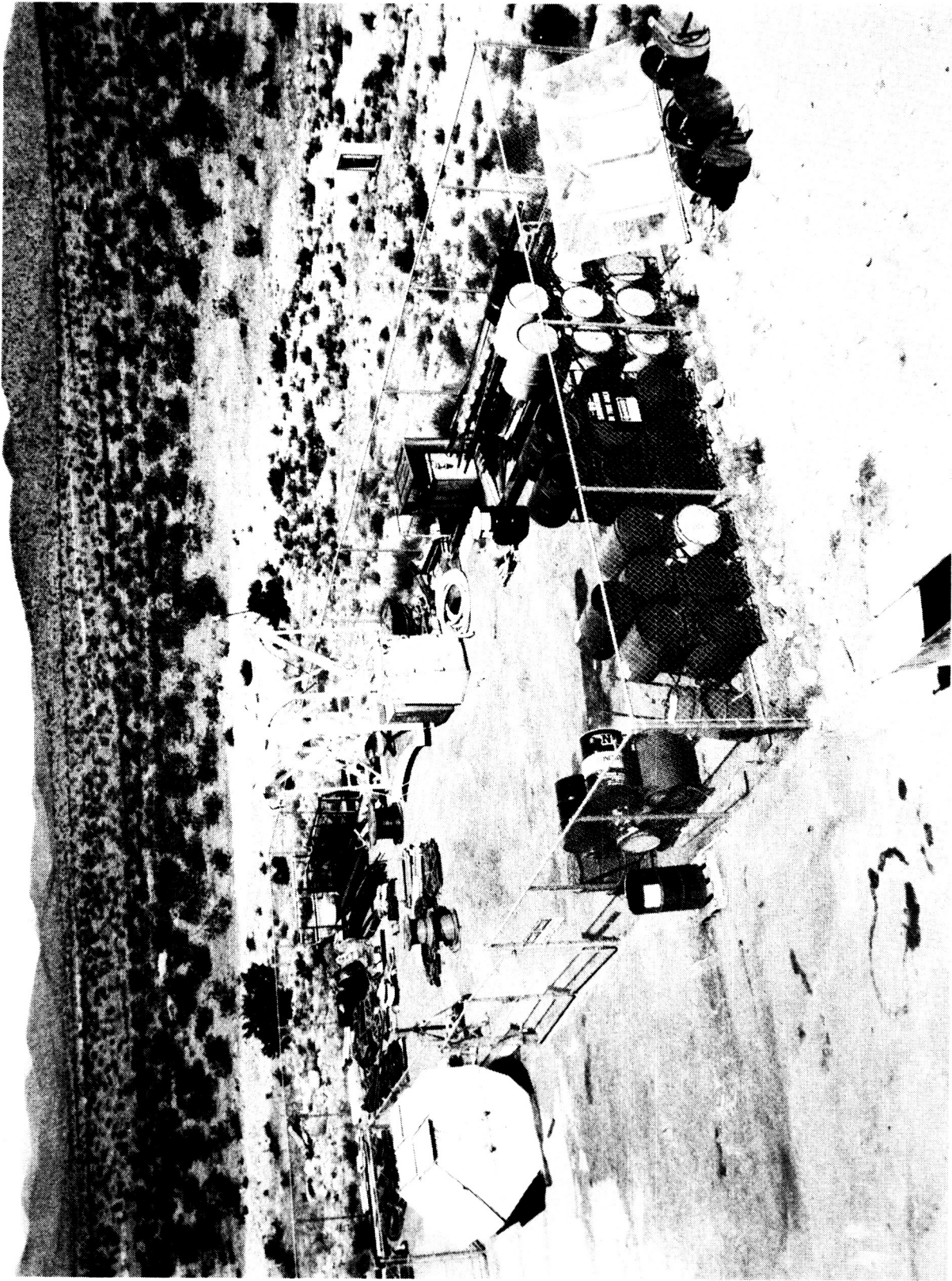


Figure 1. Mars Site: Primitive, Substandard Storage Area for Hazardous Materials and Wastes Will be Replaced by New, Environmentally Acceptable Storage Facility in 1990.

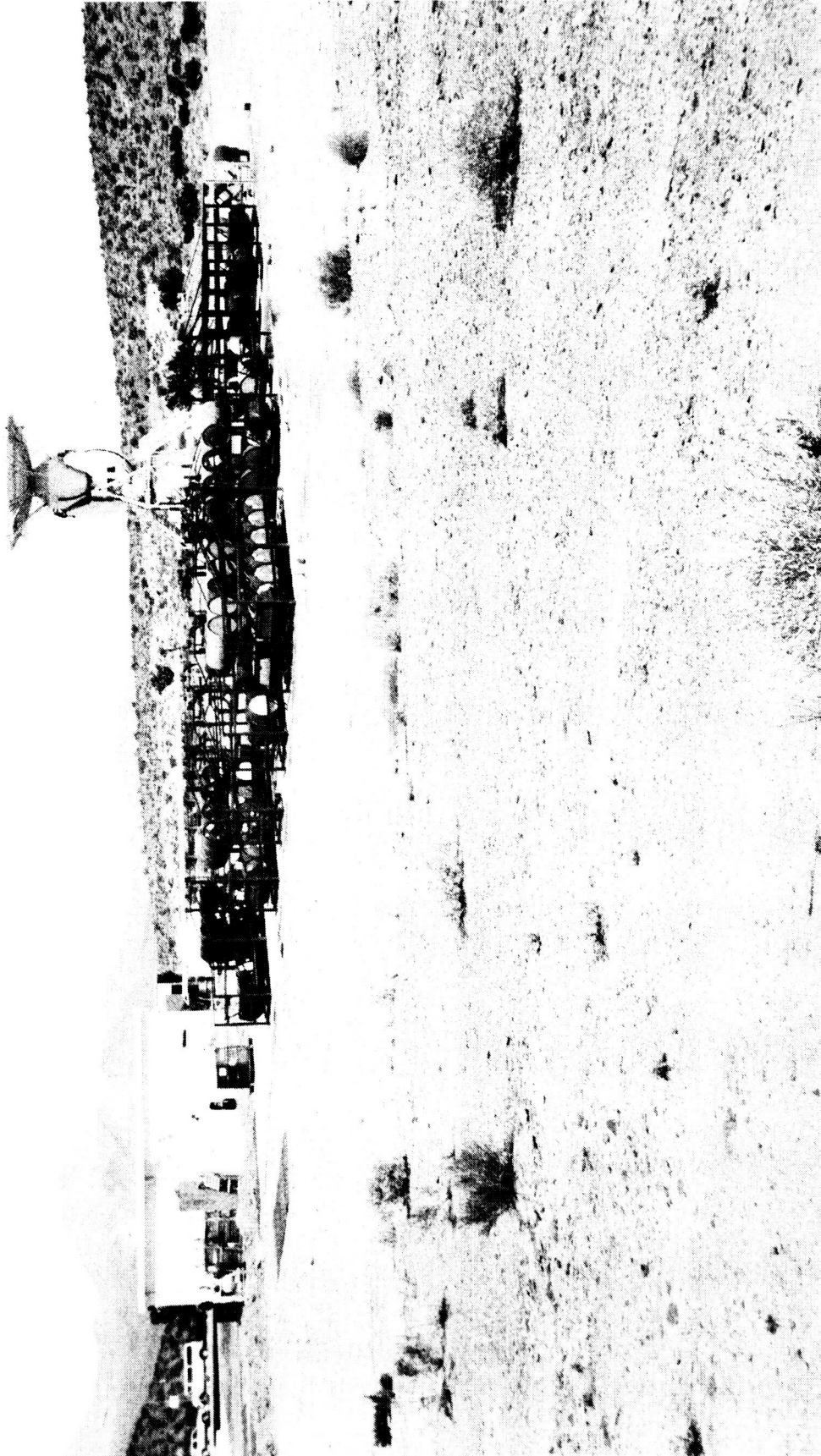


Figure 2. Apollo Site: Primitive Substandard Storage Area for Hazardous Materials and Wastes Will be Replaced by New, Environmentally Acceptable Storage Facility in 1990.

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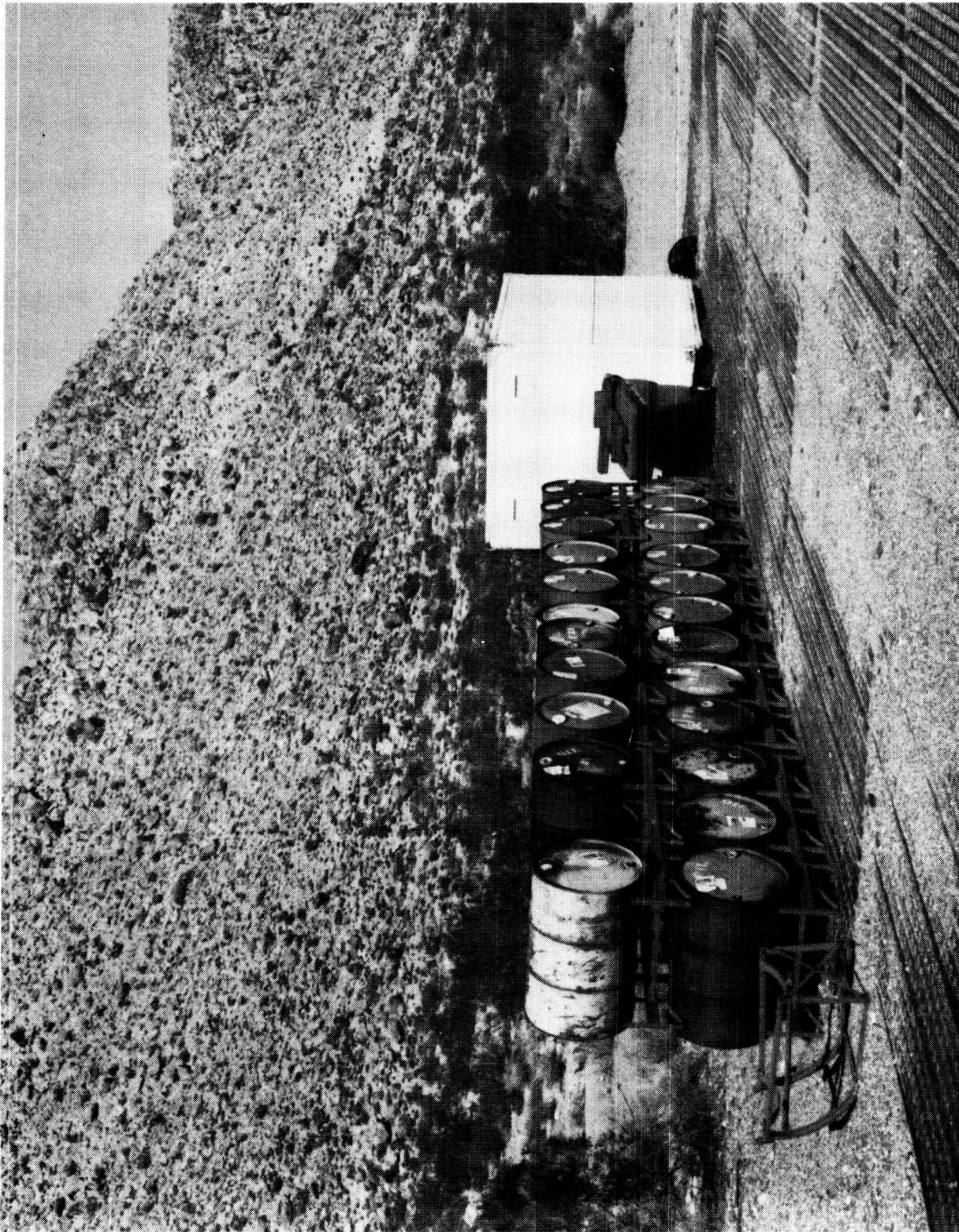


Figure 3. Venus Site: Primitive, Substandard Storage Area for Hazardous Materials now Replaced by New Storage Facility that Complies with Environmental Regulations

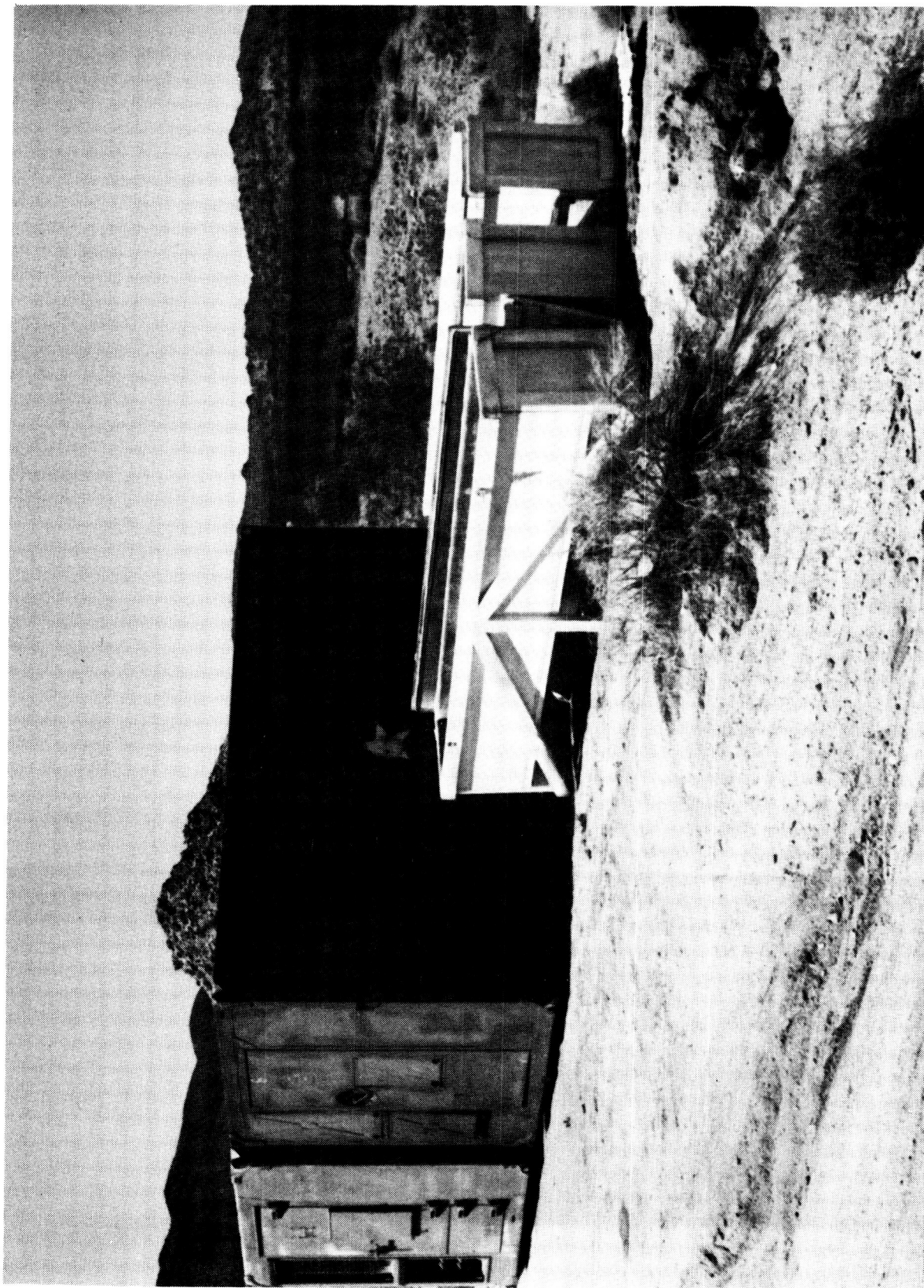


Figure 5. Venus Site: Primitive, Acid-Wash Tanks that were Replaced by New Acid-Wash Facility that Complies with Environmental Regulations

In 1988, however, the GDSCC did maintain several storage facilities that served for the storage of hazardous materials needed in everyday operations and as collection points for the accumulation of small volumes of hazardous and recyclable wastes. Under current environmental rules, because none of these collection points stored wastes for more than 90 days, these small-volume collections and storage facilities did not need a formal permit to operate. Although no operation-permit is needed, these less-than-ninety-day collection points are subject to environmental regulations.

As pointed out in the MBGA Environmental Compliance Audit of May 1986, several of the storage collection points within the GDSCC were substandard in their handling or dispensing of hazardous materials and wastes. Contaminants from drums of waste oil and solvents stored directly on the ground could leak out and seep into the ground and surrounding area.

Thus, these substandard, environmentally unacceptable collection points at the GDSCC had to be replaced with environmentally acceptable storage facilities that would meet Federal, state and county requirements and standards for worker health and safety.

Hazardous materials and wastes regulations are extremely complex. For more than a decade they have been subject to almost continual change. The numerous and diverse environmental regulations that govern the management of hazardous materials and wastes are detailed in Section V of Environmental Projects: Volume 3, Environmental Compliance Audit Final Report, JPL Publication 87-4, September 15, 1987.

E. REPLACEMENT OF STORAGE FACILITIES FOR HAZARDOUS MATERIALS AND WASTES AT THE GDSCC

As a user of hazardous materials, and as a defined generator of hazardous wastes, the GDSCC needed new, environmentally acceptable facilities for the storage of hazardous materials and wastes.

In May 1986, when the Environmental Compliance Audit conducted by MBGA found the GDSCC environmentally deficient in its storage of hazardous materials and wastes, the day-to-day operation of the GDSCC was performed by an outside contractor. At that time, the contractor's agreement did not stipulate any responsibility for the management of the GDSCC environment.

As of now, however, in a new contractual agreement, the same outside contractor has assumed responsibility for the operation of the GDSCC in compliance with all applicable environmental regulations in general, and for the environmentally proper operation of storage facilities for hazardous materials and wastes, in particular.

Following the 1987 field studies conducted by Engineering-Science, Inc. (E-S), Pasadena, California, as to whether any possible subsurface contamination may have occurred from leakage or seepage of improperly stored hazardous materials and wastes, E-S was retained by JPL to prepare a preliminary engineering report on how best to replace existing hazardous materials and wastes storage areas at the GDSCC.

E-S considered the following alternative actions:

- (1) No action to be taken. This alternative is required under the National Environmental Policy Act (NEPA). This alternative would involve continued violation of state and county environmental regulations and, obviously, is an environmentally unsatisfactory alternative.
- (2) Upgrading of the then-existing storage facilities at their locations. This offered fewer advantages as compared to the construction of new storage sites.
- (3) Construction of a single, central storage facility at the GDSCC. This would increase transport of hazardous materials and wastes from all GDSCC sites to a single storage facility at the Complex and would offer increased possibilities for accidental releases of hazardous materials and wastes to the GDSCC environment.
- (4) Relocation of storage facilities outside of the GDSCC. For numerous reasons, this was the least-preferred action.

Thus, after consideration and rejection of the above four alternative actions, the preliminary engineering report prepared by E-S and submitted to JPL in December 1987 suggested that JPL/GDSCC construct four new storage facilities, one each at Echo Site, Venus Site, Mars Site and Apollo Site. In addition, the report suggested the construction of a new acid-wash facility at Venus Site.

In April 1988, E-S submitted an Environmental Assessment to JPL that documented existing conditions, analyzed the environmental effects to be expected from the construction, and presented mitigation measures for the proposed construction of the four storage facilities and the acid-wash facility at the GDSCC.

Because there would be insignificant environmental consequences to be expected from the proposed construction, E-S concluded that in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality implementing regulations, and the NASA implementation provisions, the proposed construction of four hazardous materials and wastes storage facilities and an acid-wash facility at the GDSCC is eligible for a Finding of No Significant Impact (FONSI).

In July 1988, E-S submitted the final Engineering Design Drawings, including calculations and specifications, that described in detail the work that was necessary to construct two new storage facilities for hazardous materials and wastes at Echo and Venus Sites and the single new acid-wash facility at Venus Site.

JPL then contracted with E-S to oversee the construction work, and the Jenkin Construction Company, Long Beach, California, to carry out the construction of the two storage facilities and the acid-wash facility. The facilities are designed and located to comply with both the Uniform Building Code and the Uniform Fire Code.

This present report deals with the work undertaken to construct a single, new acid-wash facility at Venus Site, and two new storage facilities for hazardous materials and wastes, one at Echo Site and one at Venus Site.

The storage facility at Echo Site is designed to handle both hazardous wastes and hazardous materials, while the storage facility at Venus Site is designed to handle only hazardous materials.

Construction work was begun in December 1988 and was completed in May 1989. Thus, the GDSCC now has two, environmentally acceptable storage sites for hazardous materials and wastes, one at Echo Site and the other at Venus Site. An environmentally acceptable acid-wash facility also is located at Venus Site. Similar storage facilities for hazardous materials and wastes are to be constructed at Mars and Apollo Sites in 1990. The geographic locations of these five new facilities at the GDSCC are shown in Figure 6.

The Echo Site storage facility for hazardous materials and wastes is surrounded by a security fence.

SCHEMATIC MAP OF GDSCC SHOWING SITE LOCATIONS

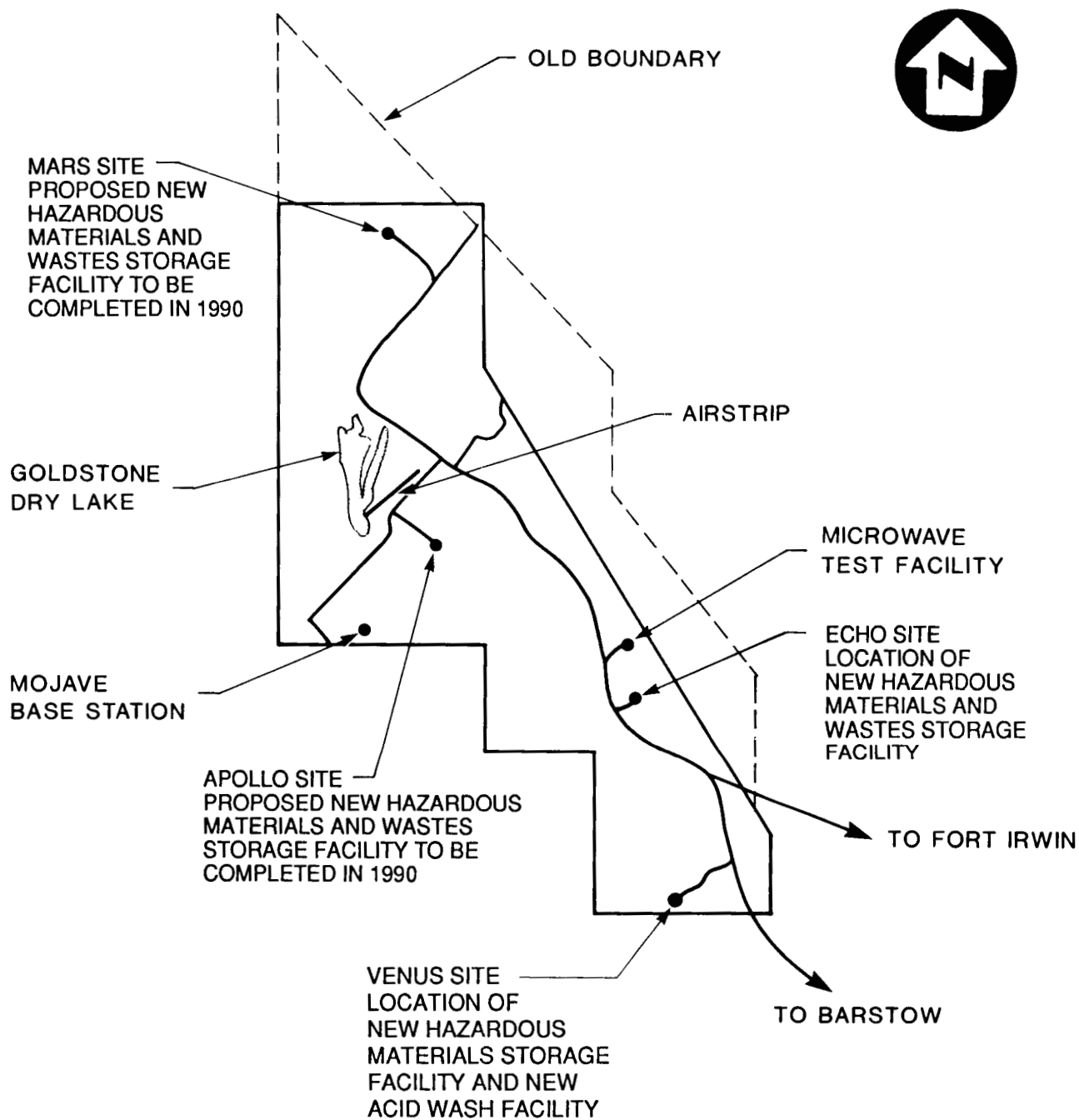


Figure 6. Schematic Map of the GDSCC Showing Locations of Two Newly Constructed and Two Proposed Storage Facilities for Hazardous Materials and Wastes and One Newly Constructed Acid-Wash Facility

SECTION II

THE GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX (GDSCC)

A. LOCATION OF THE GDSCC

The Goldstone Deep Space Communications Complex (GDSCC) is located in southern California in a natural, bowl-shaped depression in the Mojave Desert, in San Bernardino County about 40 miles north of Barstow, California, and about 160 miles northeast of Pasadena, California, where the Jet Propulsion Laboratory (JPL) is located.

As indicated in Section I, the GDSCC is part of the National Aeronautics and Space Administration's (NASA) Deep Space Network (DSN), one of the world's largest and most sensitive scientific telecommunications and radio navigation networks. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory of the California Institute of Technology in Pasadena, California.

The 52-square-mile Goldstone Complex lies within the western part of the Fort Irwin Military Reservation (Figure 7). A Use Permit for the use of the land was granted to NASA by the U.S. Army. The Complex is bordered by the Fort Irwin Military Reservation on the north, east and southeast, the China Lake U.S. Naval Weapons Center on the northwest, and state and Federal lands managed by the U.S. Bureau of Land Management (BLM) on the south.

B. FUNCTIONS OF THE GDSCC

After the Space Act of 1958 had accelerated U.S. plans and programs for space exploration, JPL initiated construction work at Goldstone to build the first tracking station of what is now known as the Deep Space Network (DSN). Thus, for more than three decades, the primary purpose of the DSN has been and continues today to support the tracking of both manned and unmanned spacecraft missions and to provide instrumentation for radio and radar astronomy in the exploration of the solar system and the universe.

As indicated above, in addition to its participation in numerous scientific explorations, Goldstone performs the following functions in support of DSN operations:

- (1) Tracking: Locating the spacecraft, measuring its distance, velocity and position, and following its course.
- (2) Data Acquisition: Gathering information coming in from the spacecraft.
- (3) Command: Sending of instructions from the ground that guide the spacecraft in its flight to the target. Commands also tell the spacecraft when to perform required operations, including the switching on and off of instruments for performance of the mission's scientific experiments.

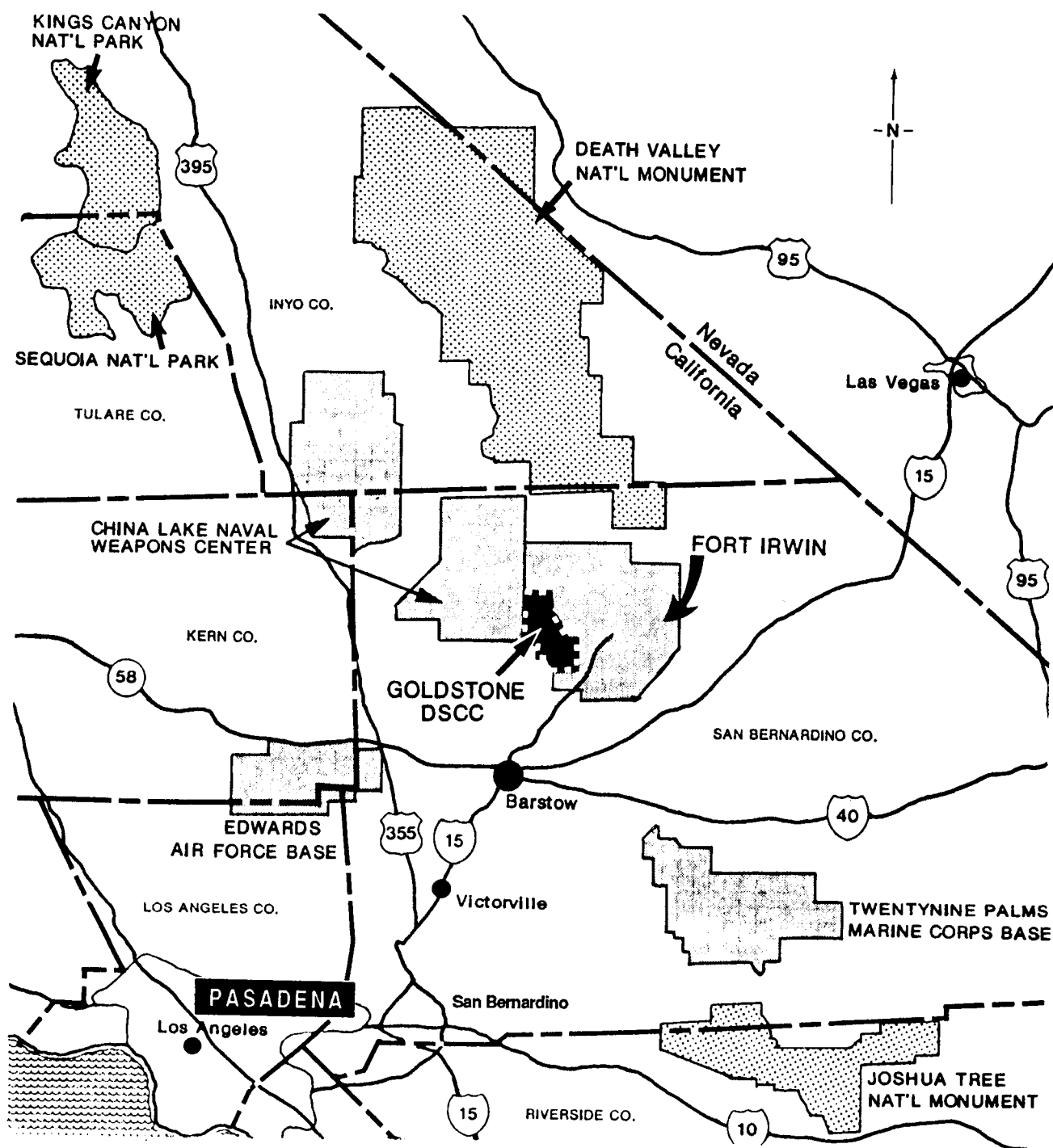


Figure 7. Geographic Relationship of the Goldstone Deep Space Communications Complex to JPL in Pasadena

Goldstone also is a research and development center to extend the communication range and to increase the data acquisition capabilities of the DSN. It serves as a proving ground for new operational techniques. Prototypes of all new equipment are thoroughly tested at Goldstone before they are duplicated for installation at overseas stations (see Section II, C below).

C. FACILITIES AT THE GDSCC

The GDSCC is a self-sufficient, working community with its own roads, airstrip, cafeteria, electrical power, and telephone systems and is equipped to conduct all necessary maintenance, repairs, and domestic support services. Facilities at the GDSCC include about 100 buildings and structures that were constructed during a 30-year period from the 1950s through the 1980s. The construction of additional buildings and structures continues today as the GDSCC increases its activities and operations.

Goldstone is one of three Deep Space Communications Complexes (DSCCs) operated by NASA that are located on three continents: at Goldstone in Southern California's Mojave Desert; in Spain, about 60 kilometers (37 miles) west of Madrid at Robledo de Chavela; and near the Tidbinbilla Nature Reserve, in Australia, about 40 kilometers (25 miles) southwest of Canberra. Because these three DSCCs are approximately 120 degrees apart in longitude, a spacecraft always is in view of one of the DSCCs as the Earth rotates on its axis (Figure 8).

Activities at the GDSCC operate in support of seven parabolic dish antennas, at five sites called Deep Space Stations (DSSs): four DSSs are operational, one is devoted to research and development (R&D) activities, and one has been deactivated. There also are four, similar, operational DSSs in Spain and in Australia. Thus, the NASA DSN consists of a worldwide network of 12 operational DSSs. In addition, an eighth parabolic dish antenna at Goldstone is operated by the National Oceanic and Atmospheric Administration (NOAA).

A Network Operations Control Center (NOCC), located at JPL in Pasadena, controls and monitors the DSN. A Ground Communications Facility (GCF) of the DSN operates to link together the NOCC at JPL with the three DSCCs at Goldstone, Spain, and Australia.

Total NASA/JPL facilities at the GDSCC (Figure 9) include the seven parabolic dish antennas, an airport, a microwave test facility, miscellaneous support buildings, and a remote support facility in Barstow located about 40 miles south of the GDSCC. The GDSCC support staff consists of about 260 personnel on site and at the Barstow facility. Table 1 summarizes the major facilities, buildings (number and square footage), and antennas (construction date and size). Three sites within the GDSCC have antennas (referred to as stations) devoted to NASA operations (Echo Site, Mars Site (two antennas), and Apollo Site). Two other sites have antennas devoted to research and development: (Venus, operated by the GDSCC, and Mojave, operated by the National Oceanic and Atmospheric Administration). A 26-meter (85 foot) antenna, located at the Pioneer Site, was deactivated in 1981. In 1985, the Pioneer antenna was designated a National Historic Landmark by the U.S. Department of Interior and the Pioneer Site was returned to the U.S. Army. Each of the Goldstone sites is briefly described below.

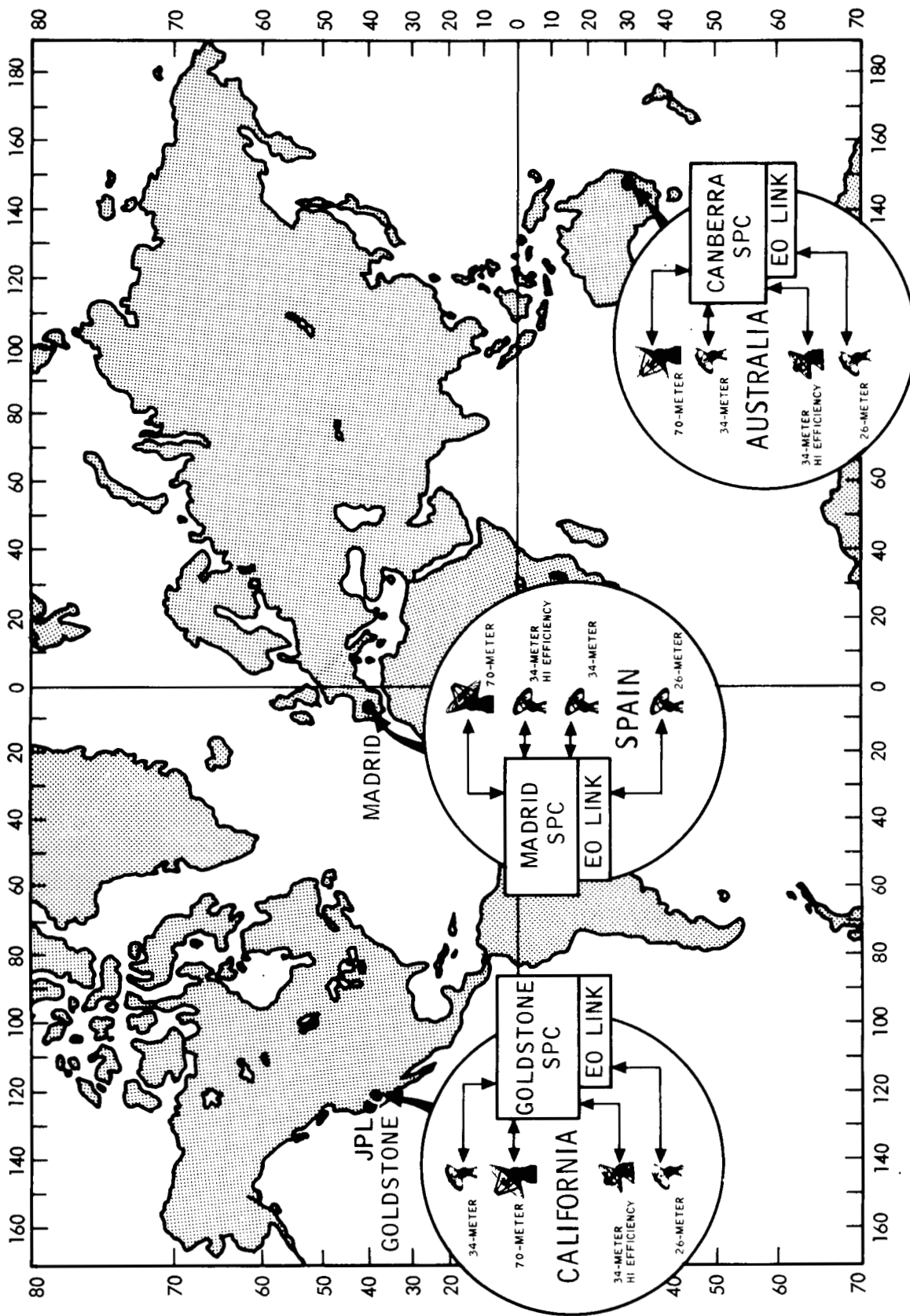


Figure 8. The Three-Continent NASA Deep Space Network as it Exists in 1989

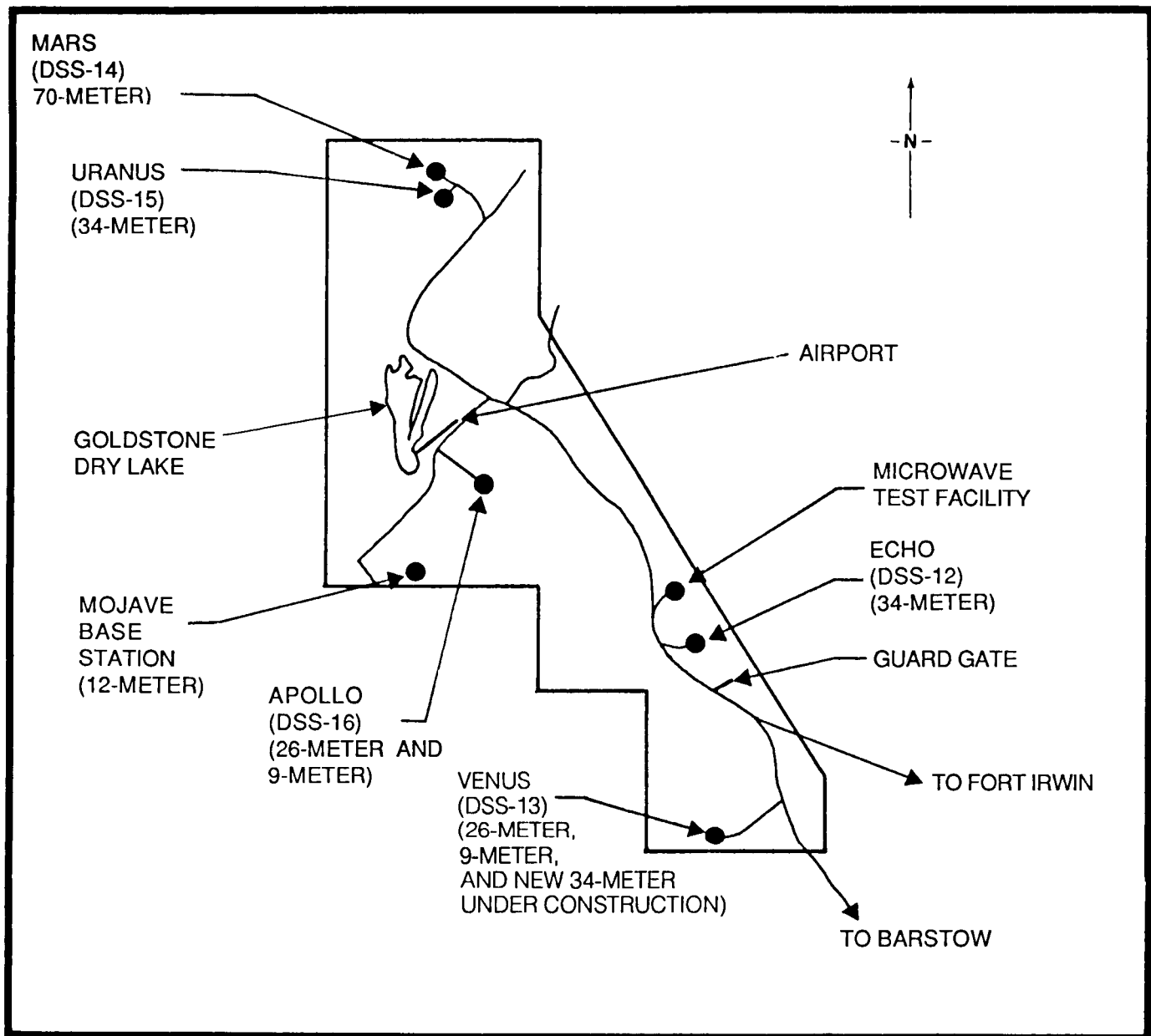


Figure 9. Schematic Map of the Goldstone DSCC Showing Locations of the Five NASA Deep Space Stations (DSSs) and the Mojave Base Station Operated by NOAA

Table 1. Major Facilities at the GDSCC

Site	Station Number	Buildings		Antennas	
		Number	SF (ft ²)	Date of Construction	Size (Meters)
Echo Site	DSS-12	24	86,662	1961 ^a	34
Venus Site	DSS-13	12	12,502	1962 ^b	26 9
Mars Site	DSS-14 DSS-15	11	36,834	1966 1984	70 ^c 34
Apollo Site	DSS-16	23	43,985	1965 ^d	26 9
Mojave Site		5	11,850	1964	12 ^e
Airport ^f		2	710	1963/1970	--
Microwave Test Facility	MTF	1	2,880	1963	--
Miscellaneous	--	3	1,430	--	--
Barstow Facility ^g		1	28,343	--	--

^aOriginal antenna, built in 1959, was moved to Venus Site in 1962. A new 26-meter antenna, built in 1961, was extended to 34 meters in 1978.

^bAntenna was constructed at Echo Site in 1959 and moved to the Venus Site in 1962.

^cOriginally constructed as a 64-meter antenna in 1966. Enlarged to a 70-meter antenna in 1988.

^dAntenna originally was constructed for the NASA Goddard Space Tracking and Data Network. JPL/GDSCC/DSN operation of the antenna began in October 1984.

^eThis antenna is operated by the National Oceanic and Atmospheric Administration (NOAA).

^fThe airport is located at the Goldstone Dry Lake.

^gThis site, a leased facility, is located in Barstow, California about 45 miles southwest of the GDSCC.

Source: Directory of Goldstone DSCC Buildings and Supporting Facilities (Gold Book, Document 890-165, JPL internal document), Jet Propulsion Laboratory and National Aeronautics and Space Administration, December 1, 1985.

D. ANTENNA STATIONS AT THE GDSCC

1. Echo Site (DSS-12)

The Echo Site, as the administration center and operations headquarters of the GDSCC, is the most extensively developed site on the complex. It has one 34-meter (111.5 ft) antenna and 24 support buildings having a combined area of 86,622 ft² (SF). Support buildings include administration and engineering offices, cafeteria and dormitory facilities, transportation and maintenance facilities, storage areas, and warehouses. Echo Station originally was built in 1959 as a 26-meter (85 foot) antenna. The antenna was first used in 1960 in support of the Echo Project, an experiment to transmit voice communications coast-to-coast by bouncing radio signals off the reflective Mylar surface of a passive balloon-type satellite. In 1962, this original 26-meter antenna was moved to the Venus Site. In anticipation of this move, a newer 26-meter antenna had been built at the Echo Site in 1961. In 1978, this antenna was enlarged to 34 meters (111.5 ft). The present antenna is approximately 35 meters (113 feet) high and weighs about 270,000 kilograms (300 tons).

2. Venus Site (DSS-13)

The Venus Site consists of a two antennas: a 26-meter (85 ft) antenna, and a 9-meter (29.5 ft) antenna. The smaller antenna is no longer used. There are 11 buildings having a combined area of 12,502 SF. The support buildings provide space for operations control, laboratories, offices, security, workshops, warehouses, and mechanical equipment. The 26-meter antenna, which was originally located at Echo Site, was moved to the Venus Site in 1962. The antenna was used for a radar astronomy study of the planet Venus. Currently, its primary function is research and development and performance and reliability testing of high power radio-frequency transmitters and new systems and equipment prior to their introduction into the Deep Space Network. A new 34-meter (111.5 ft) antenna is now under construction to replace the 26-meter antenna. The new antenna is planned to begin research and development activities in 1991. An Environmental Assessment concerning this new antenna is the subject of JPL Publication 87-4, Volume 6, Environmental Assssment: New 34-Meter Antenna at Venus Site (June 15, 1988).

3. Mars Site (DSS-14 and DSS-15)

The Mars Site consists of two antennas and 13 buildings with a combined area of 36,834 SF. The support buildings provide facilities for operations control, offices, training, mechanical equipment, storage, and security. In May 1989, M.B. Gilbert Associates (MBGA), Long Beach, California, submitted to JPL an Environmental Assessment concerning the construction work needed for a proposed addition to the Operations Building (Bldg. G-86) at the Mars Site. This environmental assessment will be the subject of a future JPL report in this continuing series of Environmental Projects reports about the GDSCC.

The Mars Station Antenna (DSS-14), at 70-meters (210 ft) in diameter, is one of the larger antennas of its kind in the world (see Front Cover). The antenna, which was constructed as a 64-meter antenna in 1966 and enlarged to

70-meters in 1988, is 7.25 times more powerful and sensitive than a 26-meter antenna, extending the range of deep space communications by 2.7 times. It can maintain communications with spacecraft even to the edge of the solar system. Standing more than 235 ft high, this antenna is one of the more striking features to be seen in the GDSCC geographic area. The 70-meter antenna was used in August 1989 for the Voyager 2 spacecraft's encounter with the planet Neptune, which is located at a distance from Earth of 4.5 billion kilometers (2.8 billion miles).

The Uranus Station Antenna (DSS-15) is a 34-meter, high efficiency (HEF), precision-shaped antenna, located approximately 1,600 ft southeast of the Mars Station Antenna. Built in 1984, this latest antenna-addition at the GDSCC first was used in January 1986 to support the encounter of the Voyager 2 spacecraft with the planet Uranus, which is located at a distance of more than 3 billion kilometers (1.8 billion miles) from Earth. The new, proposed 34-meter antenna now under construction at the Venus Site (see above) is similar in size and structure to this Uranus antenna.

4. Apollo Site (DSS-16)

The Apollo Site has a 26-meter (85-ft) antenna, a 9-meter (29.5 ft) antenna, and 18 buildings having a combined area of 43,985 SF. The buildings provide space for operations, equipment, storage, and warehousing. The 26-meter antenna originally was constructed in 1965 by the NASA Goddard Space Tracking and Data Network to support the manned Apollo missions to the moon. Operation of this antenna under the JPL/GDSCC/DSN began in October 1984. Both the 26-meter and the 9-meter antennas now are used to support the missions of the Space Shuttle (STS) and satellites in both low- and high-Earth orbits. In May 1989, M.B. Gilbert Associates, Long Beach, California, submitted to JPL an Environmental Assessment concerning the construction work needed for a proposed new 34-meter antenna at the Apollo Site. This environmental assessment will be the subject of a future JPL report in this continuing series of Environmental Projects reports about the GDSCC.

5. Mojave Base Site (NOAA Antenna)

The Mojave Base Site has five buildings with a combined area of 11,850 SF. At one time, these buildings provided support facilities for operations, equipment, and maintenance. Except for the NOAA operations buildings, however, these buildings now are not in use.

The Mojave Base Station Antenna is a 12-meter (40-ft) antenna operated by NOAA. The antenna is involved in several programs including monitoring of shifts in the Earth's plates, monitoring weather changes, and retrieving information from very low-orbiting Earth satellites.

E. SUPPORT FACILITIES AT THE GDSCC

1. Goldstone Dry Lake Airport

The airport consists of an approximately 6,000 ft by 100 ft paved runway. There are two buildings at the airport site, both of which are

presently not in use. An open hangar is used to provide shelter for a single aircraft. For its personnel, NASA operates three scheduled shuttle flights per week to the GDSCC that originate from the Burbank-Glendale-Pasadena Airport. In addition, the Goldstone airport is used infrequently by administrative Army flights. Both NASA and the U.S. Army use propeller-driven aircraft.

2. Microwave Test Facility and Fire Training Area

The Microwave Test Facility (MTF) and Fire-Training Area consists of a single building of 2,880 SF along with areas identified for fire fighting. The MTF is used for research and development testing of antenna equipment. Fire training includes procedures for the quenching of fires.

3. Miscellaneous Buildings in the GDSCC Area

Three buildings and structures at the GDSCC that fall into this category include the main gatehouse, pump house, and radio spectrum monitor. Total area of these three buildings/structures is 1,430 SF.

4. Off-Site Facility at Barstow, California

In addition to the above-mentioned on-site facilities, the GDSCC leases an office and warehouse support facility in the nearby city of Barstow. The facility is a single story, 28,343 SF structure located at 850 Main Street.

F. NON-STRUCTURAL SUPPORT FACILITIES AT THE GDSCC

1. Transportation Network

The major roadways in the area are shown in Figure 10. The only surface public transportation route to the GDSCC is by the Fort Irwin Road that leads to Fort Irwin. The NASA Road cutoff from Fort Irwin Road leads into the GDSCC. NASA Road merges with Goldstone Road, which is the only north-south paved access road within the complex. Both NASA and Goldstone Roads are paved two-lane roads and are maintained by the Ft. Irwin Post Engineer. Two-lane paved access roads also lead to each of the sites and major facilities.

2. Utilities and Services

The Southern California Edison Company provides electricity for the Goldstone Complex. The GDSCC provides its own backup diesel-engine generators for operations during emergencies and to ensure continuity of electrical service for prescheduled periods of time. Gasoline, diesel oil, and hydraulic oil are stored in underground storage tanks. Water is supplied by Fort Irwin from groundwater basin wells. Sanitary sewage is discharged through septic tank systems to leaching fields. The Echo and Mars Sites discharge wastewater to evaporation ponds.

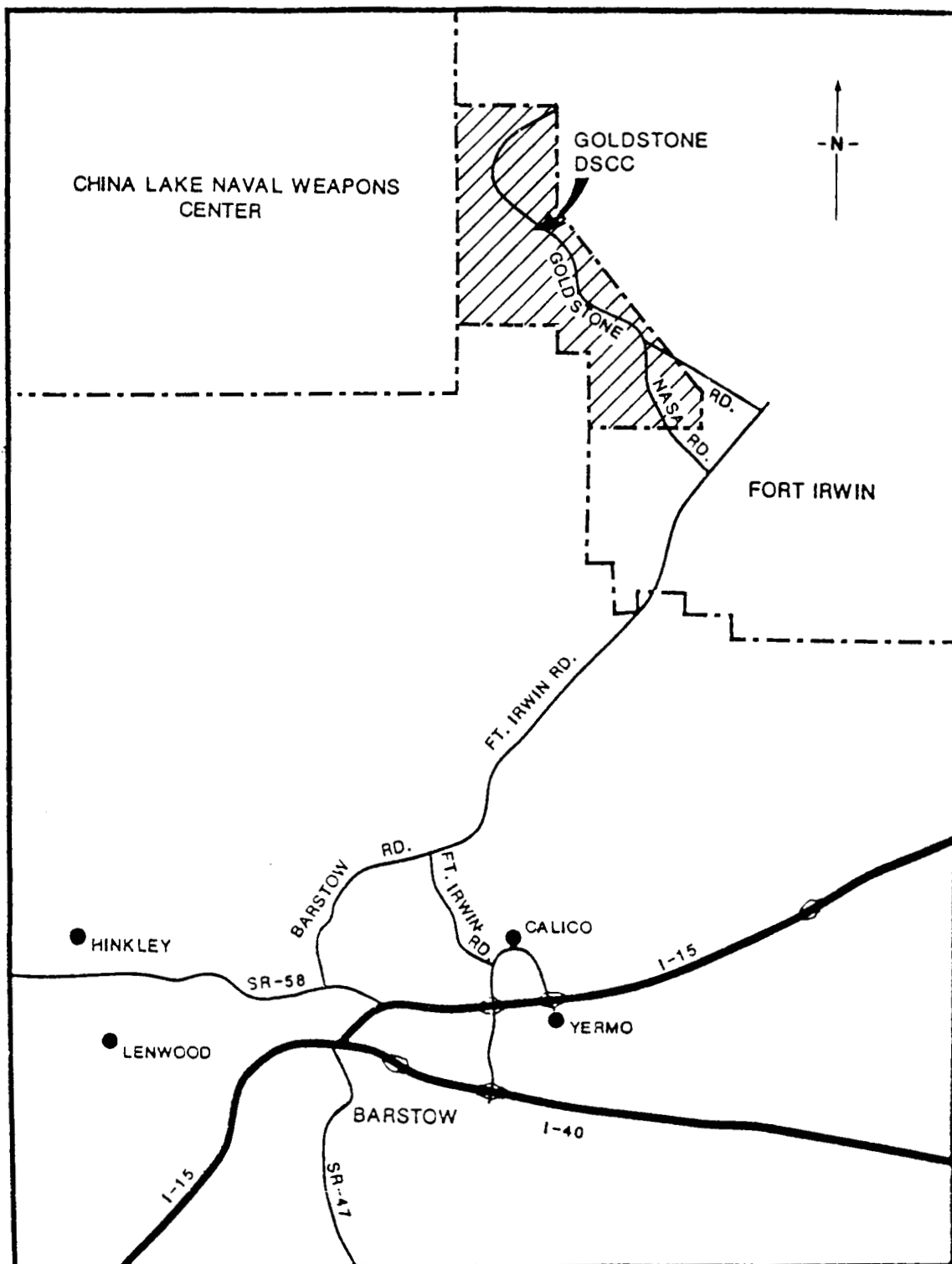


Figure 10. Major Roads Leading to and at the Goldstone DSCC

G. SOLID-WASTE MANAGEMENT FACILITIES AT THE GDSCC

At the Echo Site, the GDSCC operates its own 6-acre, Class III solid-waste landfill. This facility accepts only non-hazardous, solid wastes.

Most of a small quantity of hazardous waste, generated at the GDSCC each year, is sent to off-site commercial facilities for reclamation and eventual reuse. The remainder is transported to off-site commercial treatment or disposal facilities within 90 days of generation. The GDSCC now has two, new, properly managed storage facilities for hazardous materials and wastes, one at Echo Site and the other at Venus Site, but operates no facilities requiring a hazardous waste permit. Details concerning the construction of these two new storage facilities for hazardous materials and wastes at the Echo and Venus Sites are the subject of this present volume. Two more storage facilities for hazardous materials and wastes, one at Mars Site and the other at Apollo Site, are to be completed early in 1990. In accordance with its environmental management program, the GDSCC conducts all of its waste-management operations in strict compliance with environmental regulations, in a manner consistent with protection of human health and the environment.

H. WASTEWATER MANAGEMENT FACILITIES AT THE GDSCC

Four functioning sewage evaporation ponds - one pair at the Echo Site and another pair at the Mars Site - are designed to receive effluent from upstream septic tank systems. Extensive work was completed in the spring of 1989 to repair and reshape the previously eroded embankments of the wastewater evaporation ponds. Details of this construction work are recorded in Environmental Projects: Volume 8, Modifications of Wastewater Evaporation Ponds, JPL Publication 87-4, October 15, 1989.

I. OPERATIONAL RELATIONSHIPS BETWEEN THE GDSCC AND FORT IRWIN

Because the GDSCC is located within the Fort Irwin property, the two installations potentially can affect each other's roles and missions. Fort Irwin is a U.S. Army installation serving as the U.S. Army National Training Center (NTC). The remote desert environment allows military task forces to practice large-scale training maneuvers that could affect natural, historic, and cultural resources at the GDSCC. This especially is true when the maneuvers involve the movement of heavy equipment (tanks, large trucks) within the GDSCC. Most maneuvers occur at the eastern border of the GDSCC and every effort is made by both the GDSCC and Ft. Irwin personnel to avoid the use of sensitive areas for such maneuvers.

J. NATURAL ENVIRONMENTAL ASPECTS OF THE GDSCC

1. Geology

The GDSCC is located in a naturally-occurring bowl-shaped depression bounded on three sides by geological faults. The Garlock Fault lies to the north, while the Blackwater and Calico Faults lie, respectively, to the west and south. The GDSCC is bounded on the east by the Tiefert Mountains.

Each antenna site at the GDSCC is located on natural alluvial material, ranging in thickness from 15 feet at the Venus Site to more than 70 feet at the Echo Site. The alluvium is derived from the surrounding hills.

2. Hydrology

Groundwater in the Goldstone area is generally confined and is found at depths ranging from 170 ft near the Minitrack Site to approximately 1,000 ft below the Echo Site. Chemical analyses of the groundwater have yielded total dissolved solids (TDS) values in excess of 1,000 ppm indicating the groundwater is brackish. The Goldstone Complex currently obtains potable water from a group of wells located at Fort Irwin, approximately ten miles to the southeast.

3. Climatic Conditions

The GDSCC lies within the U.S. Naval Weather Service's Southwest Desert, Climatic Area A. Mean annual temperatures for the area range from 50° to 80°F. Temperatures can climb as high as 114°F during the summer months, and drop as low as 11°F during the winter months. Mean annual precipitation for the area is approximately 2.5 inches with most precipitation falling between November and February.

SECTION III

DESCRIPTION OF HAZARDOUS MATERIALS AND WASTES STORAGE FACILITIES AND THE ACID-WASH FACILITY AT THE GDSCC

A. GENERAL DESCRIPTION

The construction of each storage facility involved grading, compacting the earth, forming, and placement of rebars followed by pouring concrete floor slabs. Each facility has masonry block walls with an open side, and a corrugated metal roof and skirts that provide protection against sunlight and rain/snow. The structures are designed to withstand both seismic loads for Zone IV and wind loads that are typical for the GDSCC area.

Because the storage facility at the Venus Site is designed to handle only hazardous materials and no hazardous wastes, it is equipped with two-tiered racks to hold both newly delivered drums of hazardous materials for storage as well as already open drums in use to disperse hazardous substances. In the Echo Site storage structure, empty drums, waste-filled drums, and batteries are stored on chemically-resistant, non-flammable, 4 x 4 ft pallets placed on the floor.

The storage facilities' concrete floor slabs are designed specifically to handle the heavy loads of the forklifts that are used to stow away and remove drums and batteries. A ramp over the sill of the concrete floor slab accommodates the access of the forklifts. In addition, a concrete sill runs around the entire perimeter of the concrete floor slab that serves to contain any large spills and/or runoffs of stored materials.

To maintain a relatively clean surface, the concrete floor slab is not level but has a slight slope towards a sump area. The sloping interior floor has trenches, fitted with grating, that will serve to collect liquids from minor spills or from rainwater. The floor trenches and sump area are designed to contain a worst-case spill.

A three-foot high masonry-block wall rests on top of the sill of the concrete floor slab to reduce the influx of windblown dust and rainfall. The corrugated metal roofs are fitted with large downspouts, gutters, and overhanging eaves with eave skirts to minimize the amount of rainfall entering the storage site.

To comply with the CAC Article 22, Section 19 requirement that hazardous materials and wastes storage facilities have alarm/communications/safety equipment available for emergencies, each new storage facility at the GDSCC is equipped with an emergency shower and eye-wash facility, a telephone, electrical service, lights, an adequate water supply for fighting fires, fire-hose cabinets, fire extinguishers, chemical fire-fighting equipment, spill-control equipment and decontamination gear. All of the above equipment and services are placed at each storage facility in a highly visible and readily accessible location.

B. ECHO SITE: SPECIFIC DESCRIPTION OF STORAGE FACILITY FOR HAZARDOUS MATERIALS AND WASTES

The Echo Site storage facility is designed to handle mostly hazardous wastes and some hazardous materials. Located in an area between Buildings G-24 and G-27 (Figure 11), the new storage facility for hazardous materials and wastes is designed to accommodate the storage of 133 55-gal drums, six 30-gal drums, and numerous, spent, lead-acid batteries (Table 2). About 48 of the 55-gal drums and six of the 30-gal drums that contain new shipments of chemicals, oils, and solvents can be stored on three-tiered racks within the storage structure. The inside height of the storage structure is large enough to permit the use of these three-tiered racks and forklift services. The dimensions of the storage facility at the Echo Site are depicted in Figure 12.

In addition, 45 of the 55-gal drums that are empty and are awaiting proper disposal, and 40 of the 55-gal drums that contain hazardous wastes, along with lead-acid batteries, can be stored on floor-level pallets.

A 10-foot wide access aisle in the storage facility provides passage and turnaround space for forklift service. The aisle also provides access to 15 drums fitted with spigots to dispense stored materials. Overhead lighting provides safe access to and ease of identification of the stored materials.

The emergency shower and eye-wash facility is installed upon a 5 x 3 ft concrete slab provided with a dry well for drainage. Various warning signs are posted both on the outer perimeter fence and upon the storage structure itself (see Figure 13).

C. VENUS SITE: SPECIFIC DESCRIPTIONS OF THE STORAGE FACILITY FOR HAZARDOUS MATERIALS AND THE ACID-WASH FACILITY

The Venus Site storage facility will handle only hazardous materials and no hazardous wastes. The new, storage facility for hazardous materials and the new, acid-wash facility at the Venus Site are adjacent, but separate structures located near Building G-63 (Figure 14). The dimensions of the two new facilities at the Venus Site are depicted in Figure 15.

1. The Storage Structure

As indicated in Table 3, the storage facility at the Venus Site is designed to accommodate only 38 55-gallon drums in two-tiered racks. Similar to the Echo Site storage facility, the Venus Site storage structure also has a 10-ft wide access aisle to provide passage and turnaround space for forklift service.

As with the Echo Storage facility, the Venus Site storage structure also has a sloping interior floor with trenches and grating to contain any spills by directing them to a sump-receiving area.

ECHO STATION HAZARDOUS MATERIAL AND WASTE STORAGE SITE

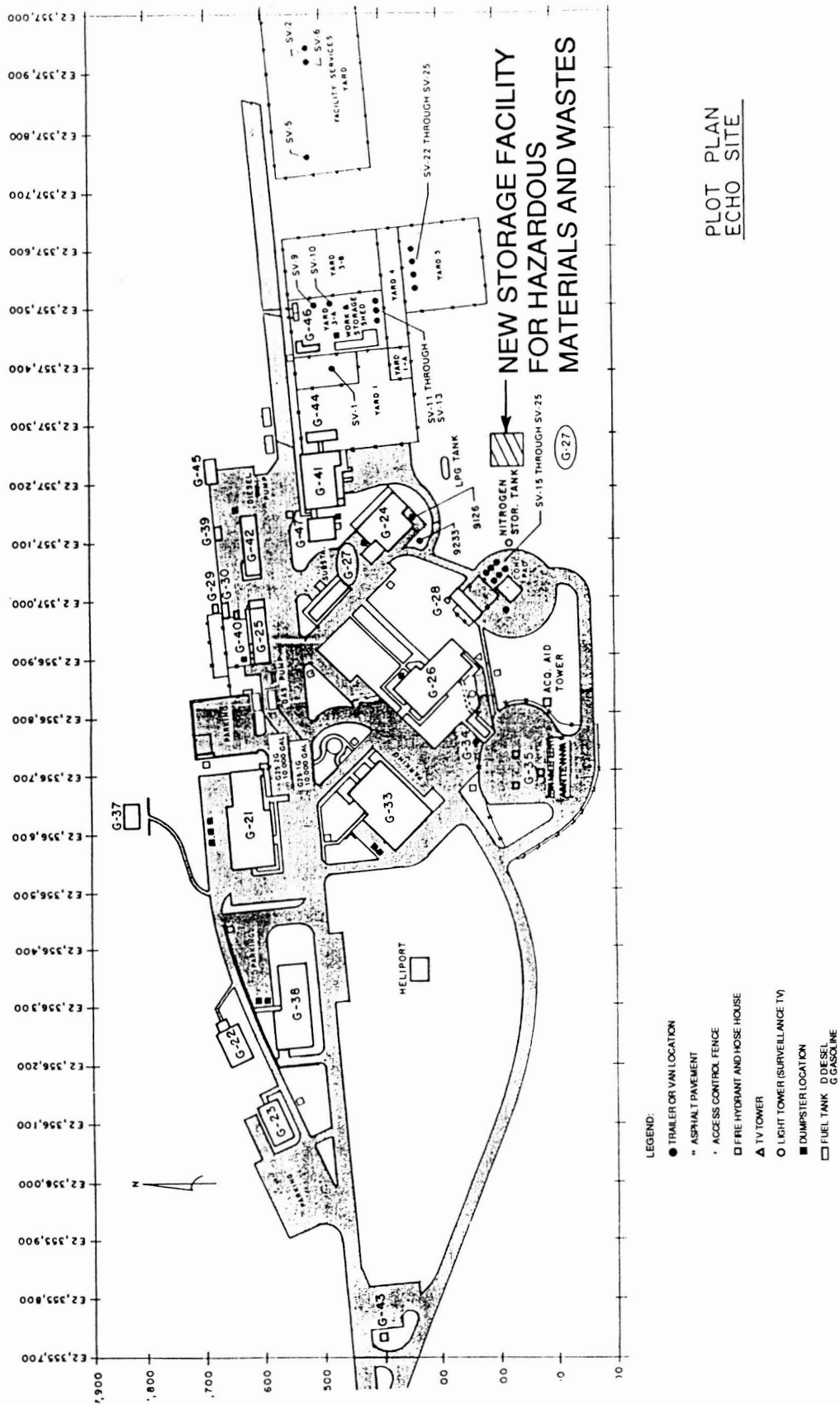


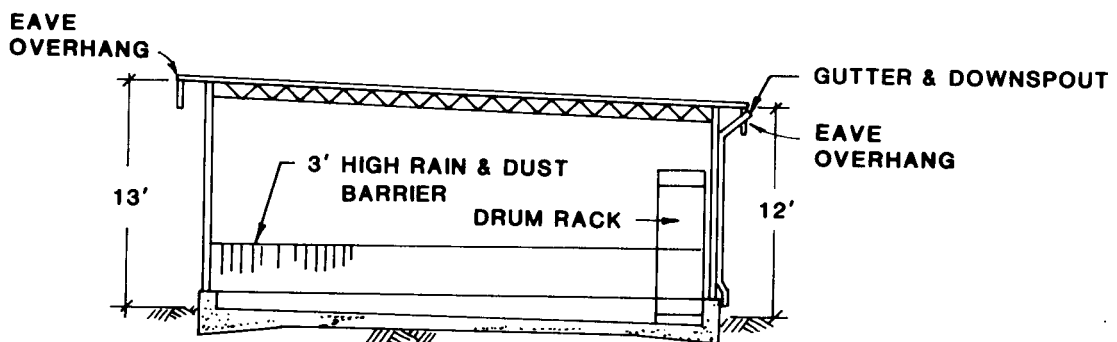
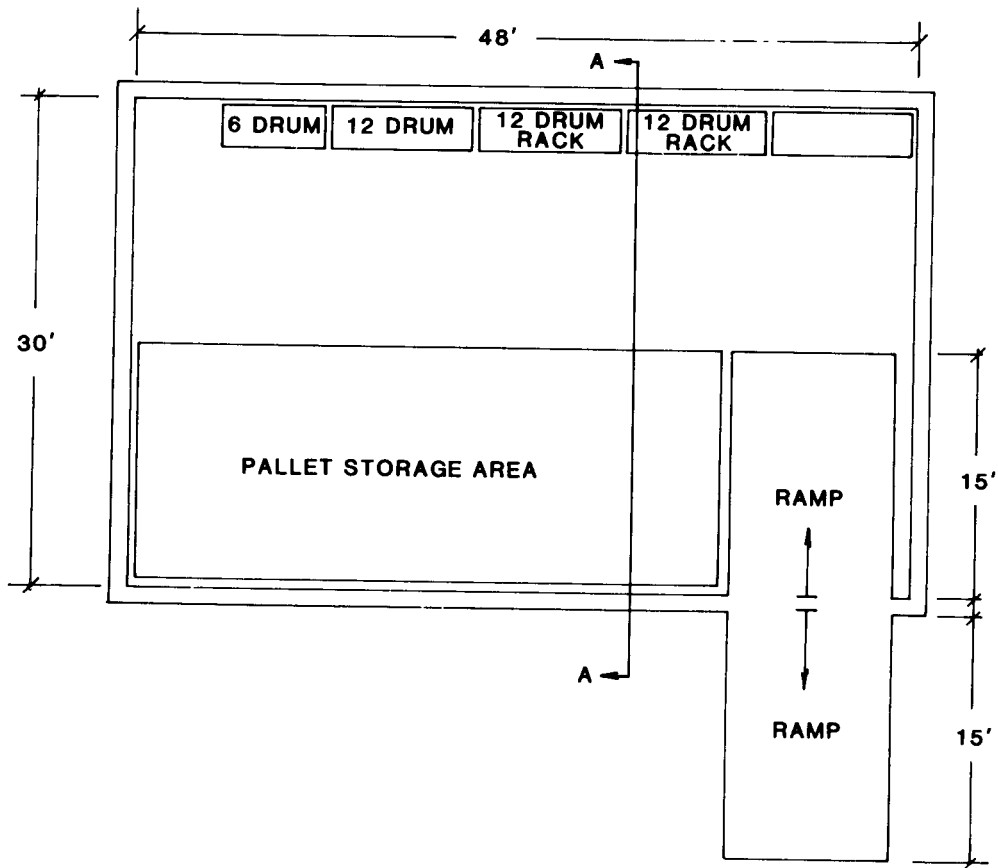
Table 2. Echo Site: Capacity of Storage Facility for Hazardous Materials and Wastes

Material	Drum Container Size (gal)	Quantity
Dentax gear oil	30	1
Duro AW #32	55	2
Ethylene glycol	55	1
Hydraulic fluid	55	4
Hydraulic oil	55	3
Kerosene	55	6
Lacquer thinner	55	2
M-50	55	2
Machine oil	55	3
Motor oil	55	1
N-L cleaner	55	1
TCE solvent	30	5
TCE solvent	55	8
Rimula 30	55	1
SHC 629 oil	55	2
Soap	55	1
Tellus 150	55	1
Tellus 32	55	4
Transformer oil	55	1
Trichlorofluoroethane	55	2
Turbine oil	55	2
Turbo 32	55	1
Empties awaiting disposal	55	45
Waste storage	55	<u>40</u>
SubTotal:	55 gallon drums	133
	30 gallon drums	<u>6</u>

Source: E-S, 1987.

TOTAL 139 Drums

ECHO STATION: HAZARDOUS MATERIALS AND WASTES STORAGE FACILITY



SECTION A-A

SCALE: 1" = 10'

Figure 12.

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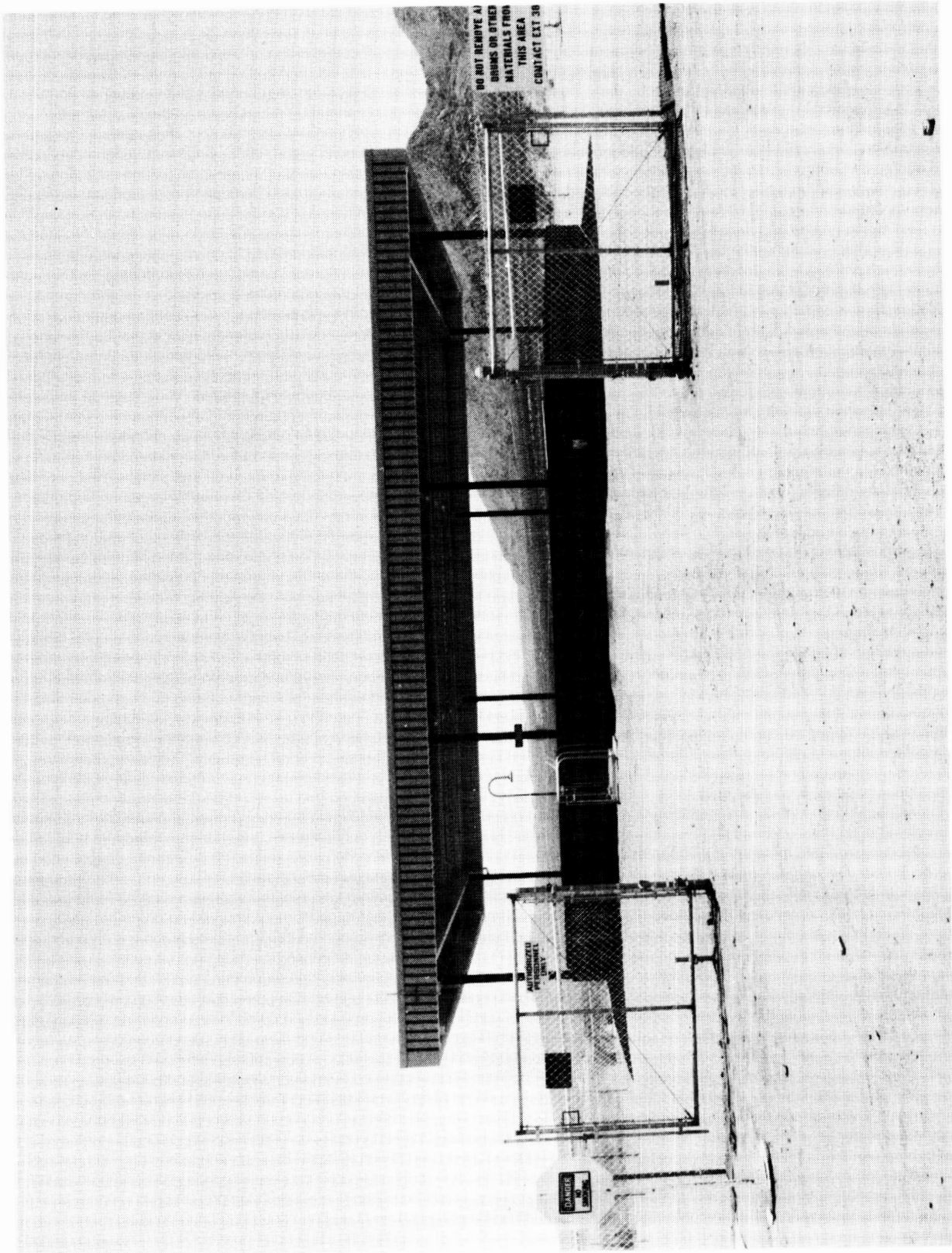


Figure 13. Echo Site: Completed Storage Facility for Hazardous Materials and Wastes.
Note the Emergency Shower and Eye-Wash Facility, the Perimeter Chain-Link Fence and Gate, and the Warning Signs

VENUS STATION: HAZARDOUS MATERIALS AND ACID-WASH FACILITIES

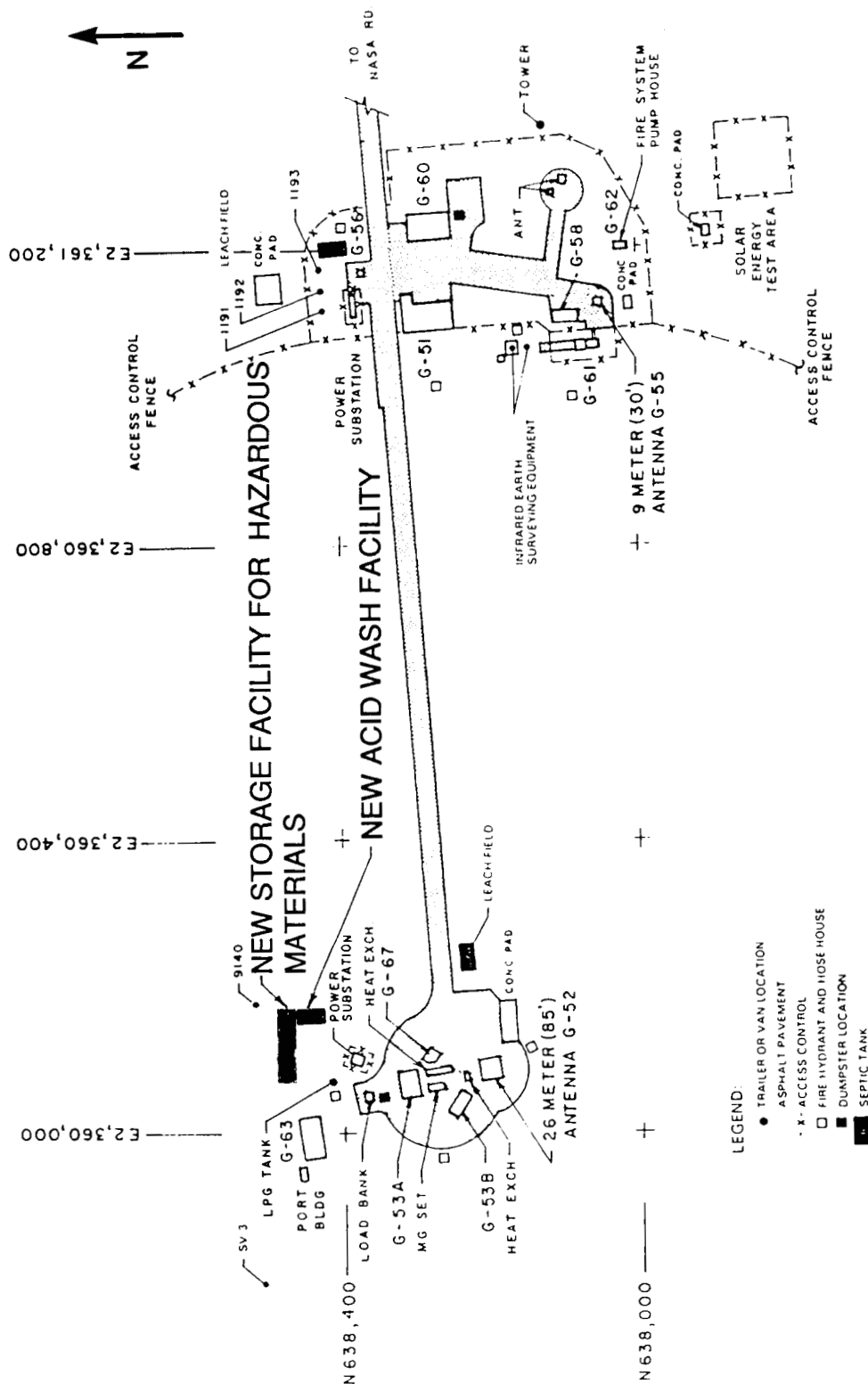
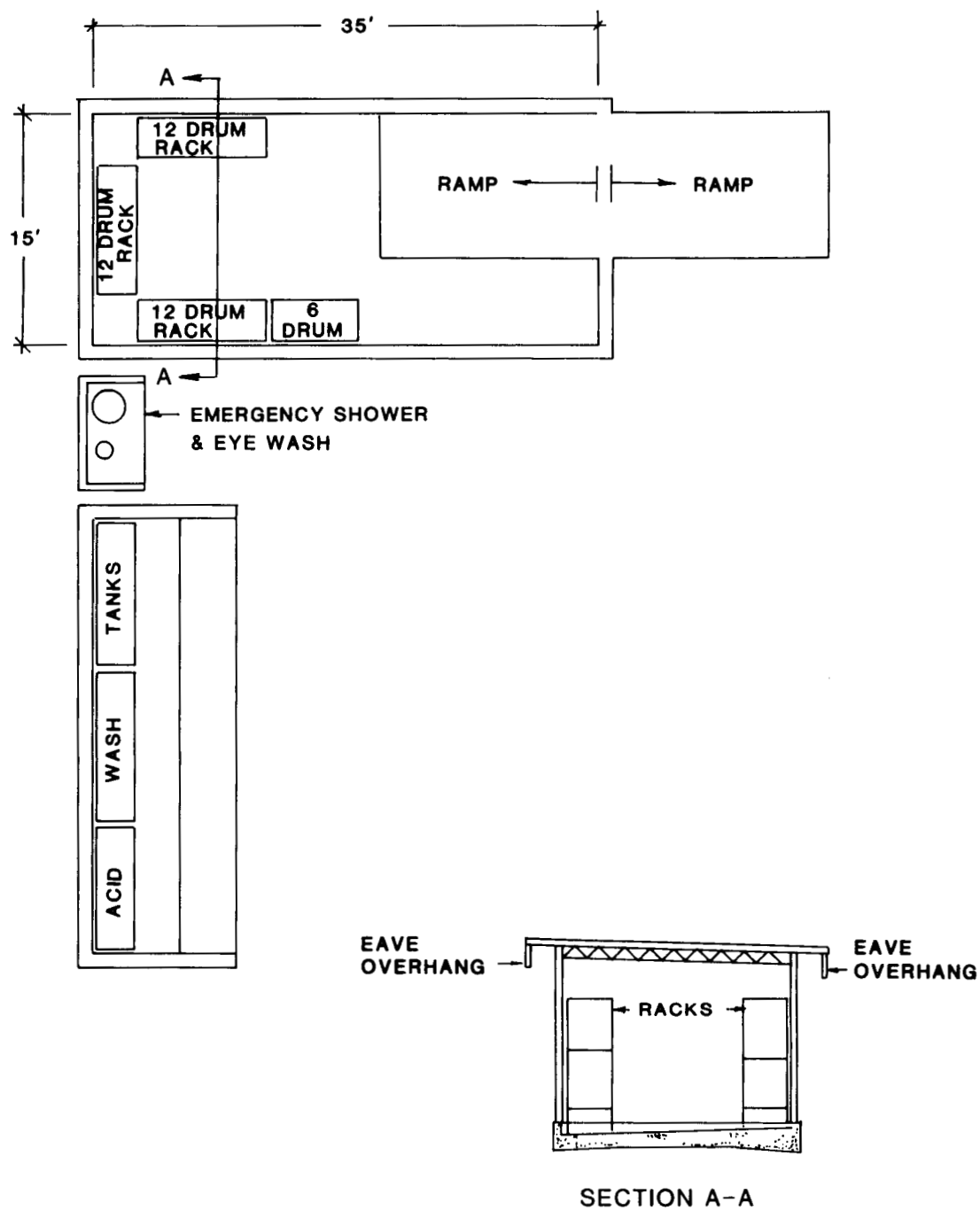


Figure 14. Venus Site: Plot Plan



SCALE: 1" = 10'

Figure 15. Venus Site: Hazardous Materials Storage and Acid-Wash Facilities

Table 3. Venus Site: Capacity of Storage Facility for Hazardous Materials

Material	Drum Container Size (gal)	Quantity
Ambrex 600W	55	2
Diala AX oil	55	5
Ethylene glycol	55	3
Hydraulic fluid	55	12
M 50 solvent	55	1
Lube oil	55	1
RCT 9 solvent	55	1
Rotella oil	55	3
Spirax gear oil	55	2
Tellus oil #29	55	5
Tellus oil #41	55	1
Turbine oil	55	<u>2</u>
Total:	55 gallon	38

Source: E-S, 1987.

An emergency shower and eye-wash facility, constructed next to the Venus Site storage facility, is identical to the emergency facility constructed at the Echo Site structure. In addition, the Venus Site storage facility is equipped with a telephone, electrical service, lights, an adequate water supply for fighting fires, fire-hose cabinets, fire extinguishers, chemical fire-fighting equipment, spill-control equipment and decontamination gear.

2. The Acid-Wash Structure

The acid-wash structure is constructed to accommodate three acid-wash cleaning tanks. To maintain a relatively clean surface, the concrete floor slab is not level, but has a slight slope towards a sump area. The sloping interior floor has trenches, fitted with grating, that will serve to collect liquids from minor spills or from rainwater. The sump area and trenches are designed to contain a worst-case spill. In addition, a concrete sill, running around the perimeter of the acid-wash tank area, is to contain any accidental spills that may occur. Easy access to the facility is provided by a ramp located across the front length of the structure.

SECTION IV

CONSTRUCTION OF TWO STORAGE FACILITIES FOR HAZARDOUS MATERIALS AND WASTES, AND OF ONE ACID-WASH FACILITY AT THE GDSCC

A. GENERAL

To construct new, environmentally acceptable storage facilities for hazardous materials and wastes, JPL retained Engineering-Science, Inc. (E-S), Pasadena, California, to prepare a Preliminary Engineering Report. The report, submitted to JPL in December 1987, recommended the construction of four new storage facilities for hazardous materials and wastes, one each at Echo Site, Venus Site, Mars Site and Apollo Site. In addition, the report recommended the construction of a new acid-wash facility at Venus Site.

In April 1988, E-S submitted an Environmental Assessment to JPL that documented the existing conditions, analyzed the environmental effects, and presented mitigation measures for the proposed construction of the five new facilities. The Environmental Assessment concluded that the proposed construction of the four storage facilities for hazardous materials and wastes, and the single acid-wash facility, would have no significant adverse impacts on the GDSCC environment.

In July 1988, E-S submitted the final Engineering Design Drawings, including calculations and specifications, that described in detail the work that was necessary to construct the three new facilities.

A contract was signed with Engineering-Science, Inc., Pasadena, California, to oversee the construction aspects of the project, while Jenkin Construction Co., Long Beach, California, was selected to be the Contractor to carry out the actual construction.

Work on the storage and acid-wash facilities at Echo and Venus Sites began in December 1988 and was completed in May 1989. A chronology of the progress of the work to construct the storage facility at Echo Site is presented in Table 4, while a similar chronology concerning the construction of the storage and acid-wash facilities at Venus Site is given in Table 5. A summary chronology of the milestones of the project is presented in Table 6.

B. STAGES OF CONSTRUCTION

Construction work began with the layout of the outlines of the three facilities, followed by earthwork to grade and excavate the areas (Figures 16, 17 and 18). Forms, along with reinforcement bars, then were put in place for the concrete foundations (Figures 19, 20 and 21). The structure was grounded by fusing copper wires to the steel bars (Cadweld grounding).

After concrete was poured to form the foundations, reinforcing bars were placed for the masonry walls (Figures 22 and 23). Separate trenches were dug to carry electrical power supplies, and domestic and fire-fighting water lines to the storage areas.

The erection of steel members that formed the structural frames of the three facilities (Figures 24 and 25) was followed by pouring of concrete to form the floor slabs of the structures (Figure 26). At about the same time, sheet-metal facings were attached to the roofs of the structures (Figures 27, 28, 29, 30 and 31). Masonry blocks then were grouted, filled, and capped to form the walls.

With the completion of the roof gutters and downspouts, the supporting structural members and the roofs of the three facilities were painted (Figures 32 and 33).

The three structures were completed by grading the exterior areas, hardening the concrete floors, and including lighting equipment and an emergency shower and eye-wash facility at each site. In addition, a grounded, perimeter, chain-link fence was put up around the Echo Site facility. Appropriate warning signs were posted on the fence and on the storage structures (see Figure 13).

Use of the storage facility at Echo Site was initiated with the storage of containers of hazardous wastes on floor pallets (Figure 34). The completed, new storage facility for hazardous materials, and the new acid-wash facility, at Venus Site (Figure 35) are in sharp contrast to the previous, substandard, environmentally unacceptable facilities at Venus Site (see Figures 3, 4 and 5).

With the completion of this construction, the GDSCC now has a new acid-wash facility at Venus Site, and two new hazardous materials and wastes storage facilities, one at Echo Site and the other at Venus Site, that not only comply with Federal, state, and county environmental regulations, but also serve to protect the health and safety of GDSCC employees. Similar storage facilities for hazardous materials and wastes are to be constructed at Mars and Apollo Sites in 1990.

Table 4. Echo Site: Chronology of the Construction of the Storage Facility for Hazardous Materials and Wastes*

1988

12 Dec. Began layout of the storage facility.

13 Dec. Began excavations, backfillings and compactions.

14 Dec. Soil samples taken for compaction-testing.

16 Dec. Began forming for the footings.

27 Dec. Started construction of panels to provide electrical service to facility.

29 Dec. Grounds at the GDSCC are frozen and compaction of soil was halted until weather permitted.

1989

9 Jan. Reinforcement bars installed.

11 Jan. Completed fusion of copper wires to steel bars (Cadweld grounding).

26 Jan. Concrete was poured for building foundation. Trenching began for the conduit to carry underground electrical power to the storage facility.

2 Feb. Poor visibility at the GDSCC. Work stopped at 11:30 a.m.

3 Feb. Strong, gusty winds at the GDSCC. Work stopped at 10:00 a.m.

6 Feb. Began backfilling of trench that carries electrical supply line from Building G-24 to the storage facility area.

8 Feb. Rain/snow closed roads to Fort Irwin and the GDSCC. No work today.

20 Feb. Began erection of structural steel.

22 Feb. Began installation of wall rebars. Began sawcutting of pavement for installation of a water-pipe trench leading from Building G-24 to the storage facility area.

24 Feb. Completed erection of structural steel.

27 Feb. Completed installation of wall rebars.

1 Mar. Began to strip forms. Installed grounding rods adjacent to the storage facility.

Table 4. Echo Site: Chronology of the Construction of the Storage Facility for Hazardous Materials and Wastes* (cont'd)

3 Mar.	Began trenching for installation of pipes to carry domestic and fire-fighting water lines from Building G-24 to the storage facility area.
8 Mar.	Began backfilling of floor-slab area and drainage trenches.
9 Mar.	Began installation of sheet-metal roof and facings. Began preparing forms for the concrete-floor slab and the drainage trenches. Began installation of various embedments in the floor-slab forms.
17 Mar.	Because of interaction with a Space Shuttle operation, the GDSCC requested delay of all construction work until 20 March.
20 Mar.	Completed installation of the 2 1/2 in. fire-fighting water lines leading to the storage facility. Began to install the masonry wall.
21 Mar.	Backfilled the trench carrying the domestic and fire-fighting water lines.
22 Mar.	Completed pouring for floor slab.
23 Mar.	Began stripping of forms from floor slab. Began finishing of floor surface.
24 Mar.	Completed grouting, filling and capping of the masonry wall. Began installation of the grounding caps and wires. Completed connections and pipe-wrappings of domestic and fire-fighting pipes.
29 Mar.	Began final grading of area around storage facility.
3 Apr.	Completed finishing of concrete floor slab.
7 Apr.	Completed installation of chain-link fence and its gates enclosing the perimeter of the storage facility area.
10 Apr.	Began painting the storage facility.
13 Apr.	Trenched and began installation of grounding wire for the chain-link fence.
21 Apr.	Prepared forms, placed rebars, and poured concrete for the emergency shower pad and splash blocks for the eye-wash facility.
25 Apr.	Continued electrical work at the storage facility. Lights installed. Completed installation of emergency shower and eye-wash equipment.
26 Apr.	General cleanup begun of storage site area.
27 Apr.	Completed electrical wiring for lighting, controls and communications.

Table 4. Echo Site: Chronology of the Construction of the Storage Facility for Hazardous Materials and Wastes* (cont'd)

28 Apr.	Began exterior grading of area around storage facility.
1 May	Finished exterior grading. Began application of hardener for concrete floor slab.
4 May	Completed grounding of chain-link, perimeter fence. Applied third coat of hardener to concrete floor slab. General cleanup of area continued.
5 May	Final inspection of storage facility.
9 May	Work at storage site completed with installation of a safety cutoff breaker.
10 May	Contractor completed as-built drawings.

*This chronology is based upon Daily Field Reports written by Engineering-Science, Inc., Pasadena, California, the Resident Engineer representing JPL.

Table 5. Venus Site: Chronology of the Construction of the Storage Facility for Hazardous Materials and the Acid-Wash Facility*

1988

- 12 Dec. Began layout of storage and acid-wash facilities.
- 13 Dec. Began excavation.
- 14 Dec. Soil was excavated to depth of six ft and then backfilled to depth of three ft. Soil was compacted and samples taken for compaction testing.
- 16 Dec. Backfilling and compaction continued.
- 22 Dec. Began excavations for footings and setting of the forms.
- 29 Dec. Grounds at the GDSCC are frozen and compaction of soil was halted until weather permitted.
- 30 Dec. Completed forms for storage facility.

1989

- 9 Jan. Rebars installed.
- 11 Jan. Completed fusion of copper wires to steel bars at both the storage and acid-wash facilities (Cadweld grounding).
- 25 Jan. Completed forming footings with setting of anchor bolts, and embedded angle and columns base-ties.
- 26 Jan. Poured concrete for footings of both facilities.
- 2 Feb. Poor visibility at the GDSCC. Work stopped at 11:30 a.m.
- 3 Feb. Strong wind gusts at the GDSCC. Work stopped at 10:00 a.m.
- 8 Feb. Rain/snow closed roads to Fort Irwin and the GDSCC. No work today.
- 10 Feb. Digging of trench, installation of electrical conduit, and backfilling between Building G-63 and the two facilities.
- 22 Feb. Began erection of structural steel.
- 23 Feb. Began installation of rebars for walls.
- 1 Mar. Concrete poured to form foundations of both facilities.
- 7 Mar. Began stripping of forms from both facilities.
- 8 Mar. Installation of grounding rods.

Table 5. Venus Site: Chronology of the Construction of the Storage Facility for Hazardous Materials and the Acid-Wash Facility* (cont'd)

10 Mar.	Began backfilling and compaction inside both facilities in preparation for pouring of concrete floor slabs.
13 Mar.	Began preparing forms and installation of various embedments for the floor-slab and drainage trenches at both facilities. Because of strong, gusty winds at the Venus Site, work at the facilities stopped at 1 p.m.
17 Mar.	Began installation of sheet-metal facings at both sites. Completed concrete pouring of floor slab and began to finish concrete surface. Because of interaction with a Space Shuttle operation, the GDSCC requested delay of all construction work until 20 March.
20 Mar.	Began to install masonry walls for both facilities.
21 Mar.	Completed masonry walls and sheet-metal work for roofs and facings of both facilities.
22 Mar.	Began installation of grounding embedments and mounting plates at the masonry walls of both facilities.
24 Mar.	Completed grouting, filling and capping of the masonry walls at both facilities.
27 Mar.	Began painting of both facilities.
7 Apr.	Completed painting of both facilities and continued finishing of concrete slab surface.
17 Apr.	Began exterior grading of areas around both facilities.
18 Apr.	Completed trenching to carry domestic water line to emergency shower and eye-wash facility located between the storage and acid-wash structures.
20 Apr.	Began installation of piping for the domestic water line to feed the emergency shower and eye-wash facility. Continuation of electrical wiring hookups and lighting installations at both facilities.
25 Apr.	Backfilled and compacted the trench carrying the domestic water line for the emergency shower and eye-wash facility. Prepared forms and rebars, and poured concrete to form the shower pad and splash blocks for the emergency facility.
27 Apr.	Began final grading of exterior area around both facilities and the placement of a base course for asphalt/concrete ramps that service both facilities.
1 May	Completed exterior grading. Prepared concrete floor slabs at both facilities to accept concrete-floor hardener.

Table 5. Venus Site: Chronology of the Construction of the Storage Facility for Hazardous Materials and the Acid-Wash Facility* (cont'd)

2 May	Applied first coat of concrete-floor hardener at both facilities. Completed asphalt/concrete paving of ramps.
4 May	Applied third coat of concrete-floor hardener at both facilities.
9 May	Work at both sites completed with installation of a safety cutoff breaker.
10 May	Contractor completed as-built drawings.

*This chronology is based upon Daily Field Reports written by Engineering-Science, Inc., Pasadena, California, the Resident Engineer representing JPL.

Table 6. Summary of Milestones Met in the Planning, Design and Construction Efforts to Construct Two, New Storage Facilities for Hazardous Materials and Wastes, and a Single, New Acid-Wash Facility at the GDSCC

1987

Aug.	Studies of possible subsurface contamination that may have been caused by leakage and seepage from improperly stored hazardous materials and wastes.
Dec.	Received Preliminary Engineering Report

1988

Jan.	Engineering design work began.
Mar.	Engineering design work 30 percent completed. Design reviewed.
Apr.	(1) Engineering design work 60 percent completed. Design reviewed. (2) Received Environmental Assessment.
May	Funds requested for construction work.
June	Engineering design work 90 percent completed. Design reviewed.
July	Engineering design work completed.
Aug.	San Bernardino County approves the design plans.
Oct.	Period ends for submission of bids by prospective contractors.
Dec.	Construction contract signed. Construction work began.

1989

May	Completed the construction of the two new storage facilities for hazardous materials and wastes (one at Echo Site and one at Venus Site) and a single, new acid-wash facility (Venus Site).
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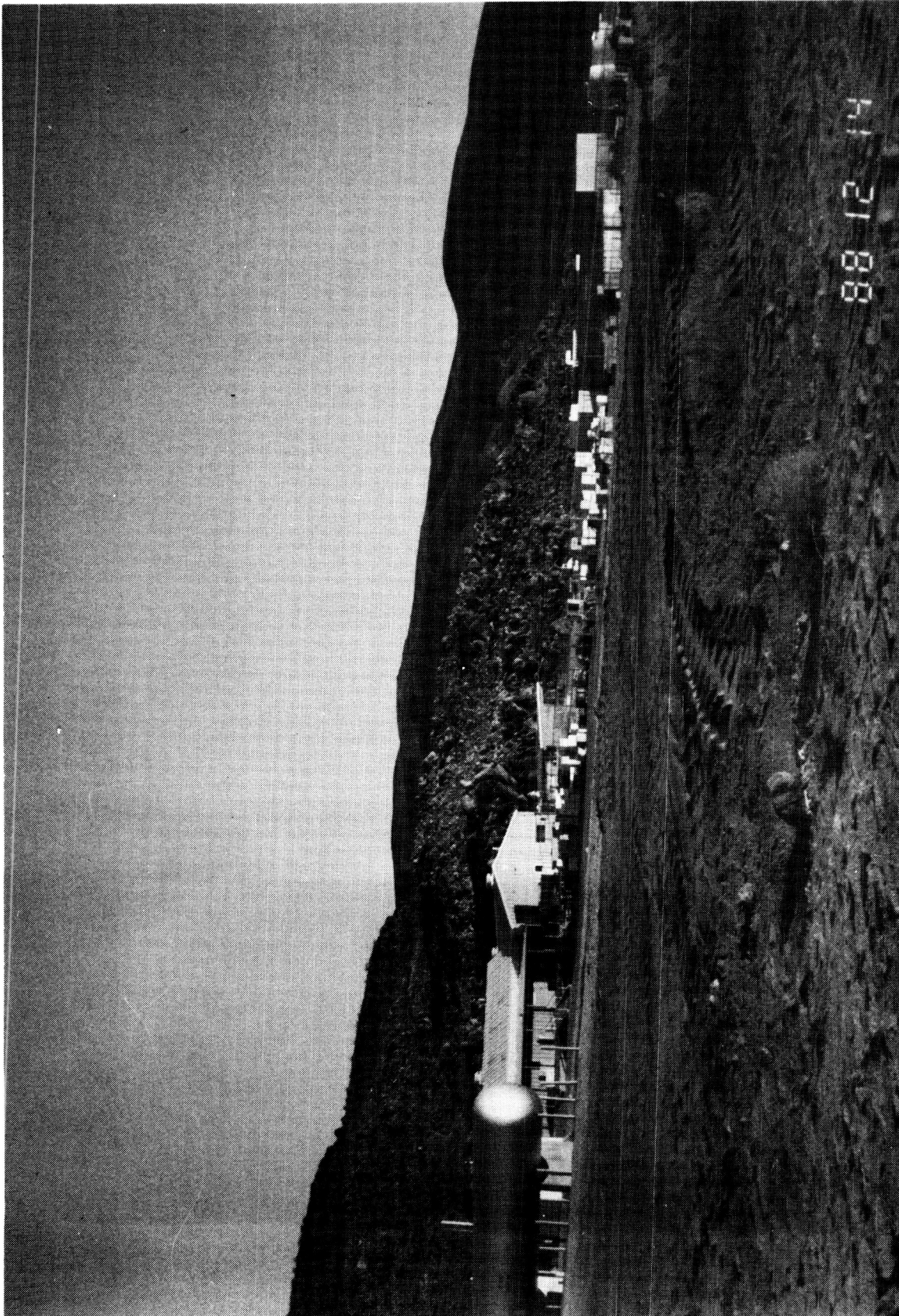


Figure 16. Echo Site: Site for Construction of Storage Facility for Hazardous Materials and Wastes

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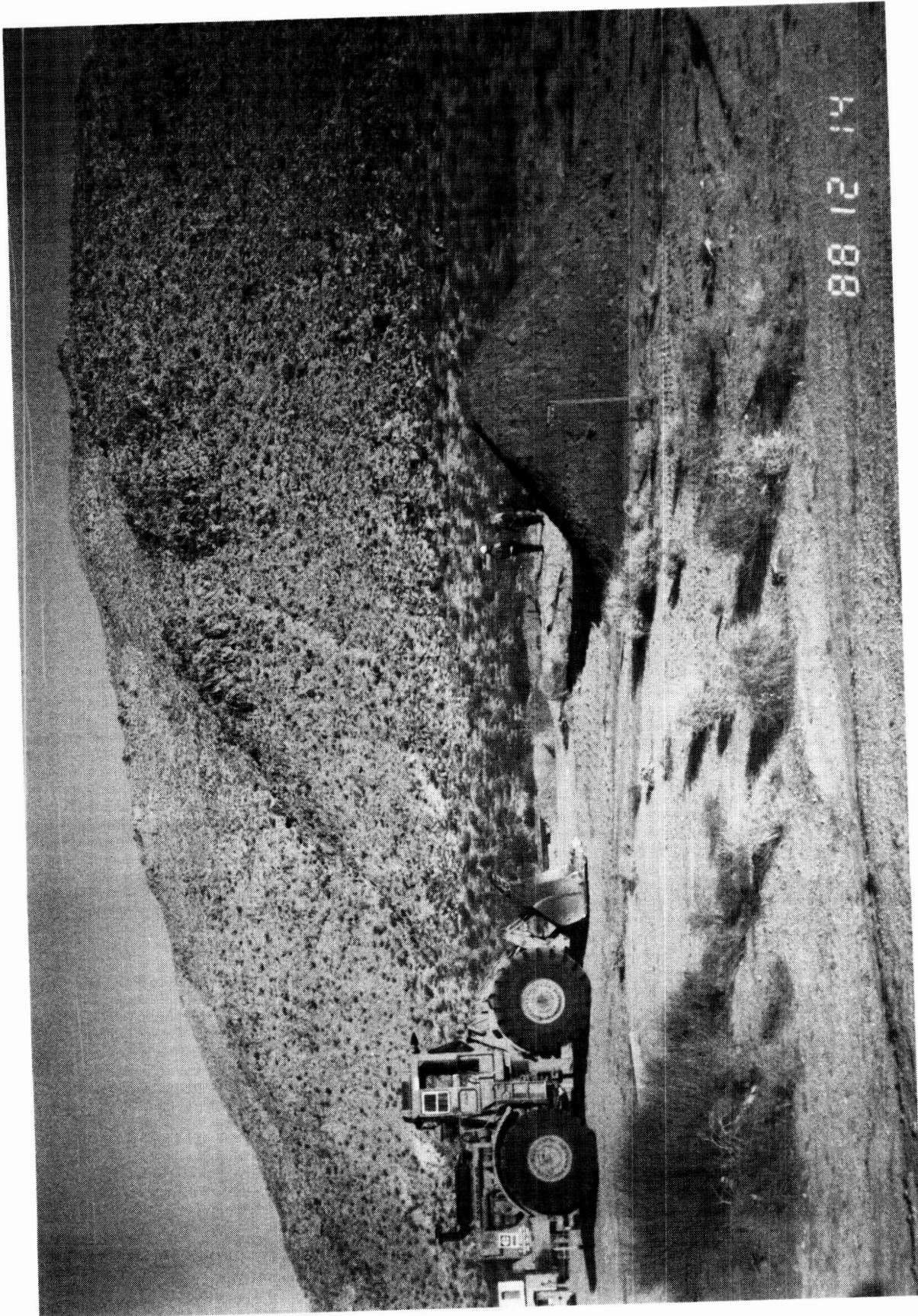


Figure 17. Venus Site: Beginning of Construction Earthwork for Storage and Acid-Wash Facilities

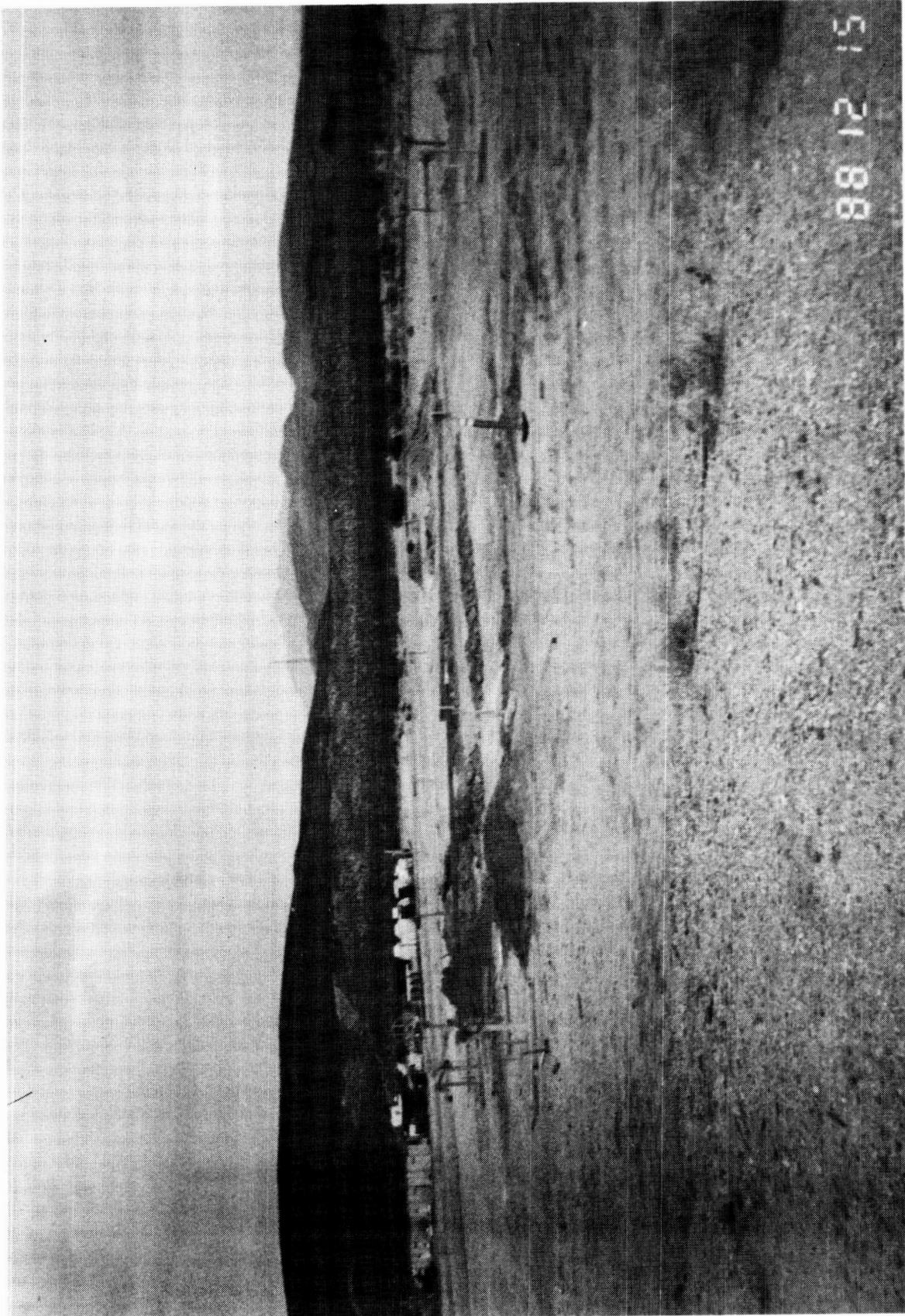


Figure 18. Echo Site: Outlined Layout for Construction of Storage Facility
for Hazardous Materials and Wastes

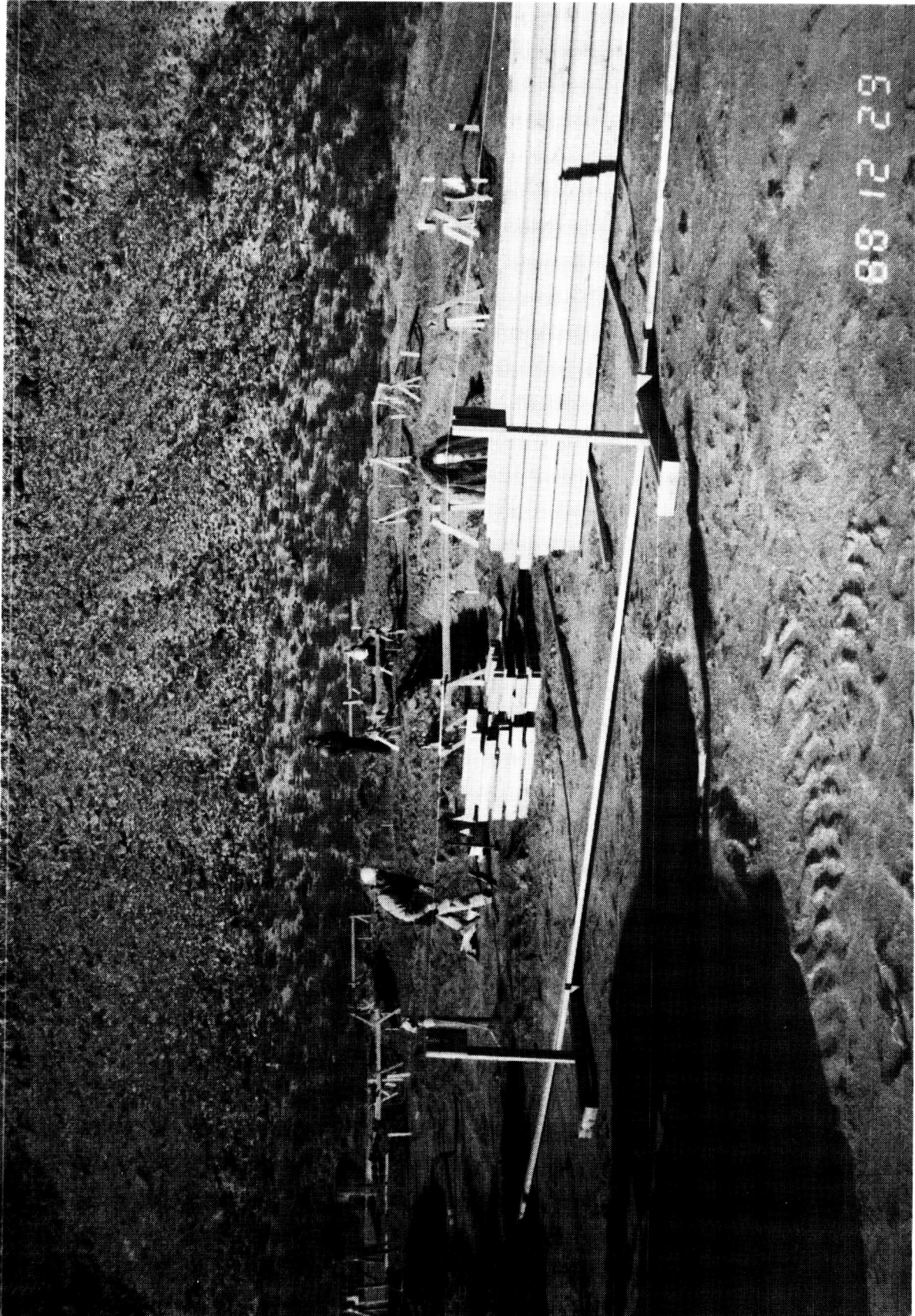


Figure 19. Venus Site: Preparations for Forming Concrete Foundations of Storage and Acid-Wash Facilities

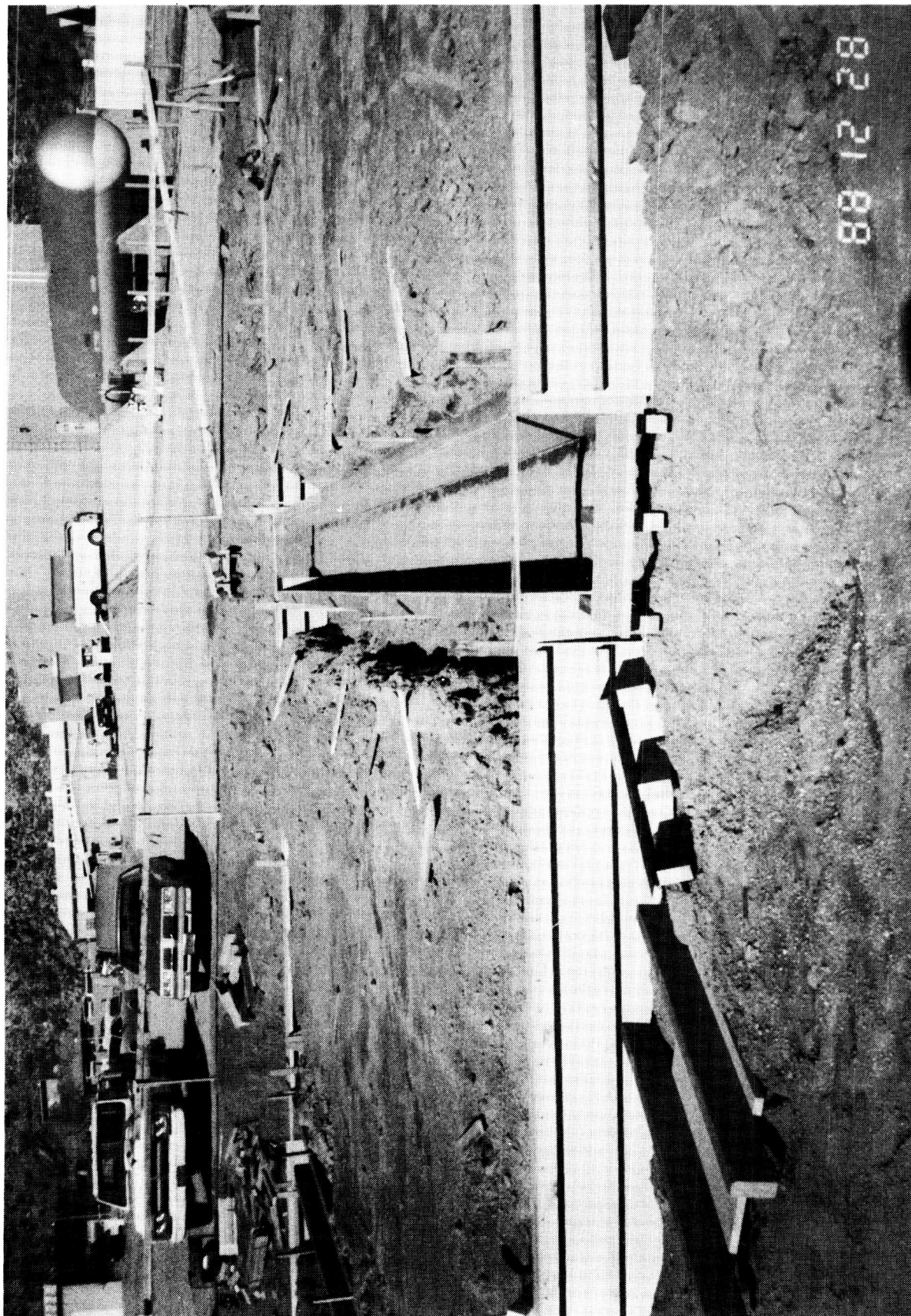


Figure 20. Echo Site: Forms in Place for Concrete Foundation of Storage Facility

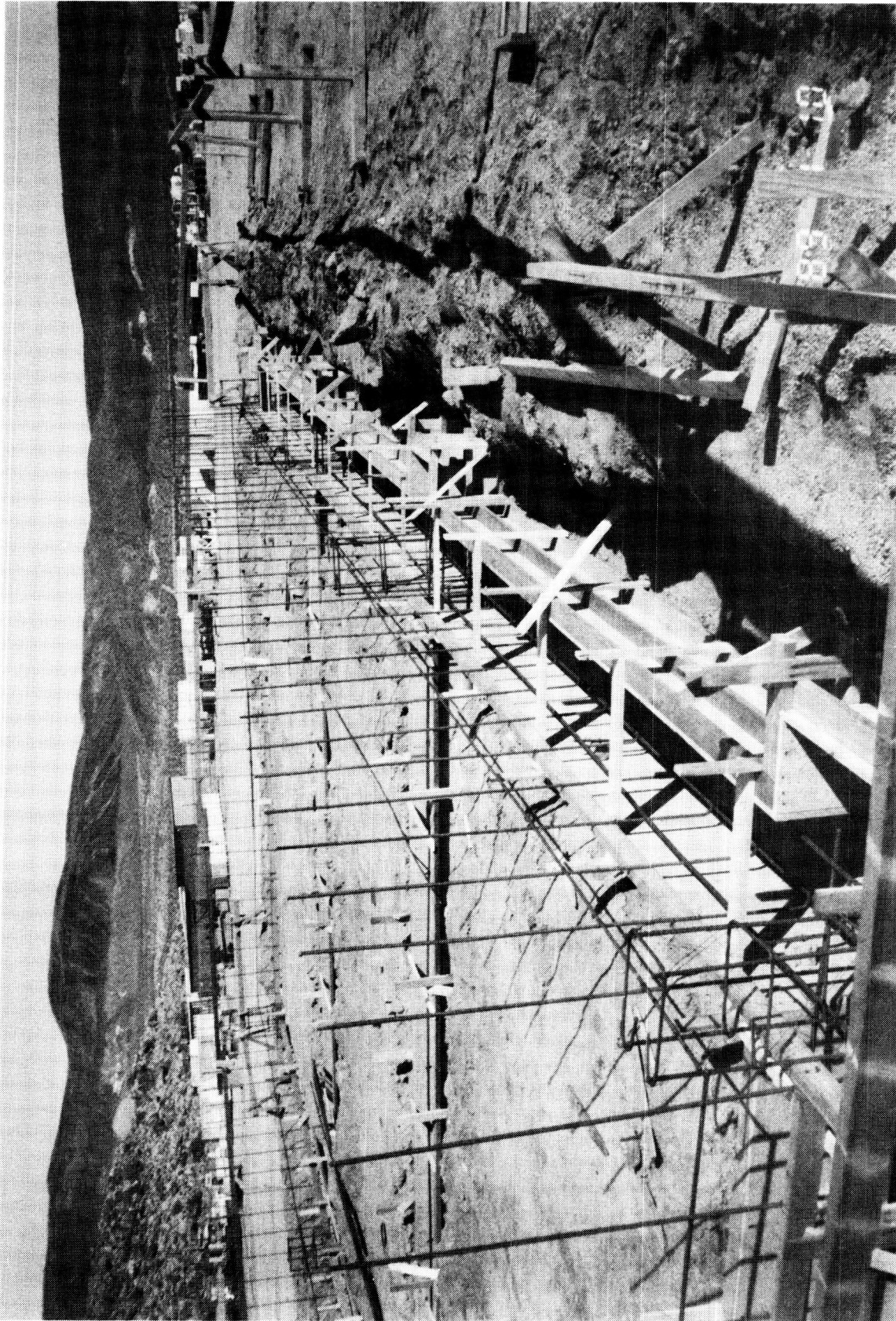


Figure 21. Echo Site: Forms and Rebars in Place for Pouring of Concrete
Foundation of Storage Facility

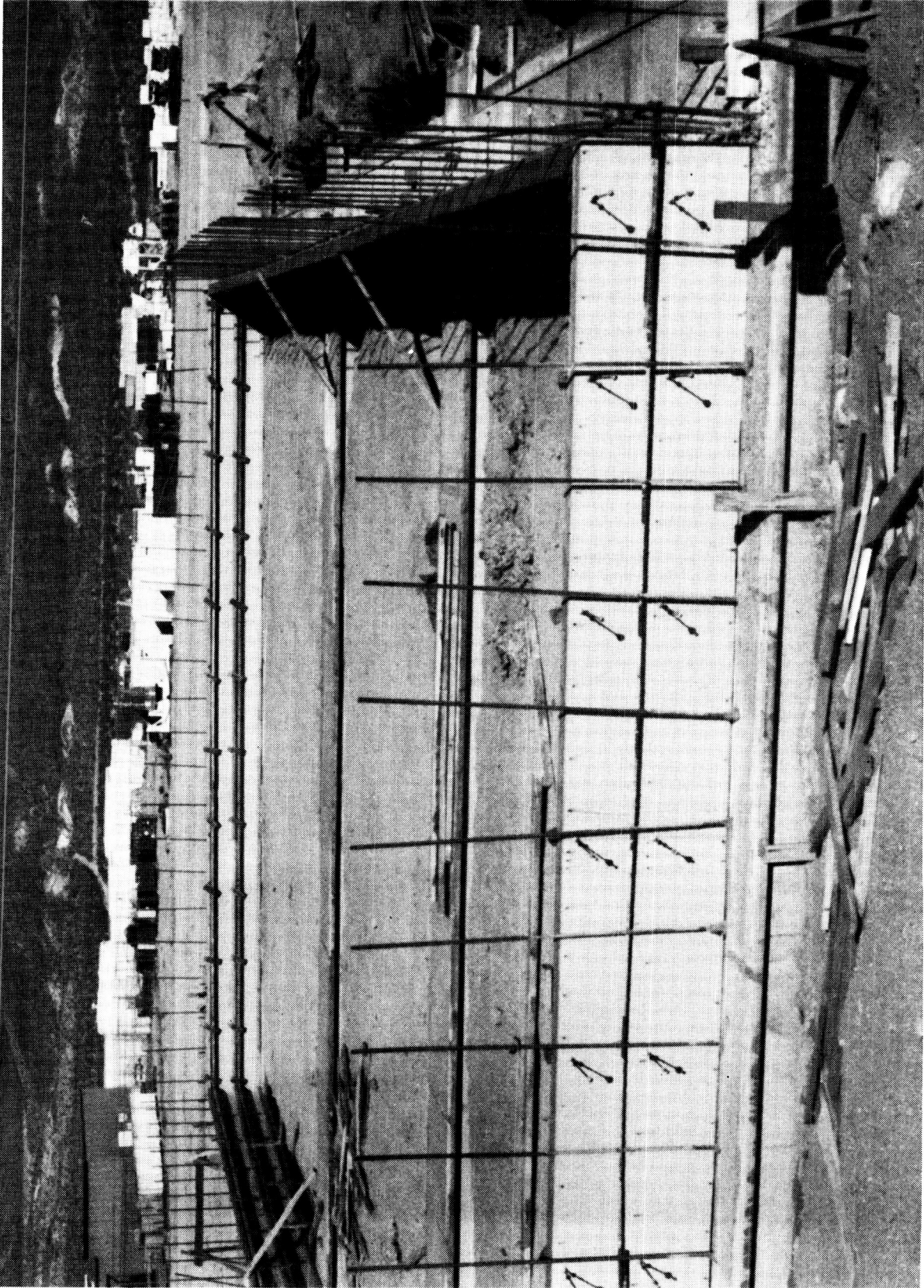


Figure 22. Echo Site: Setting of Forms for Sills and Installation of Rebars
for Walls of Storage Facility

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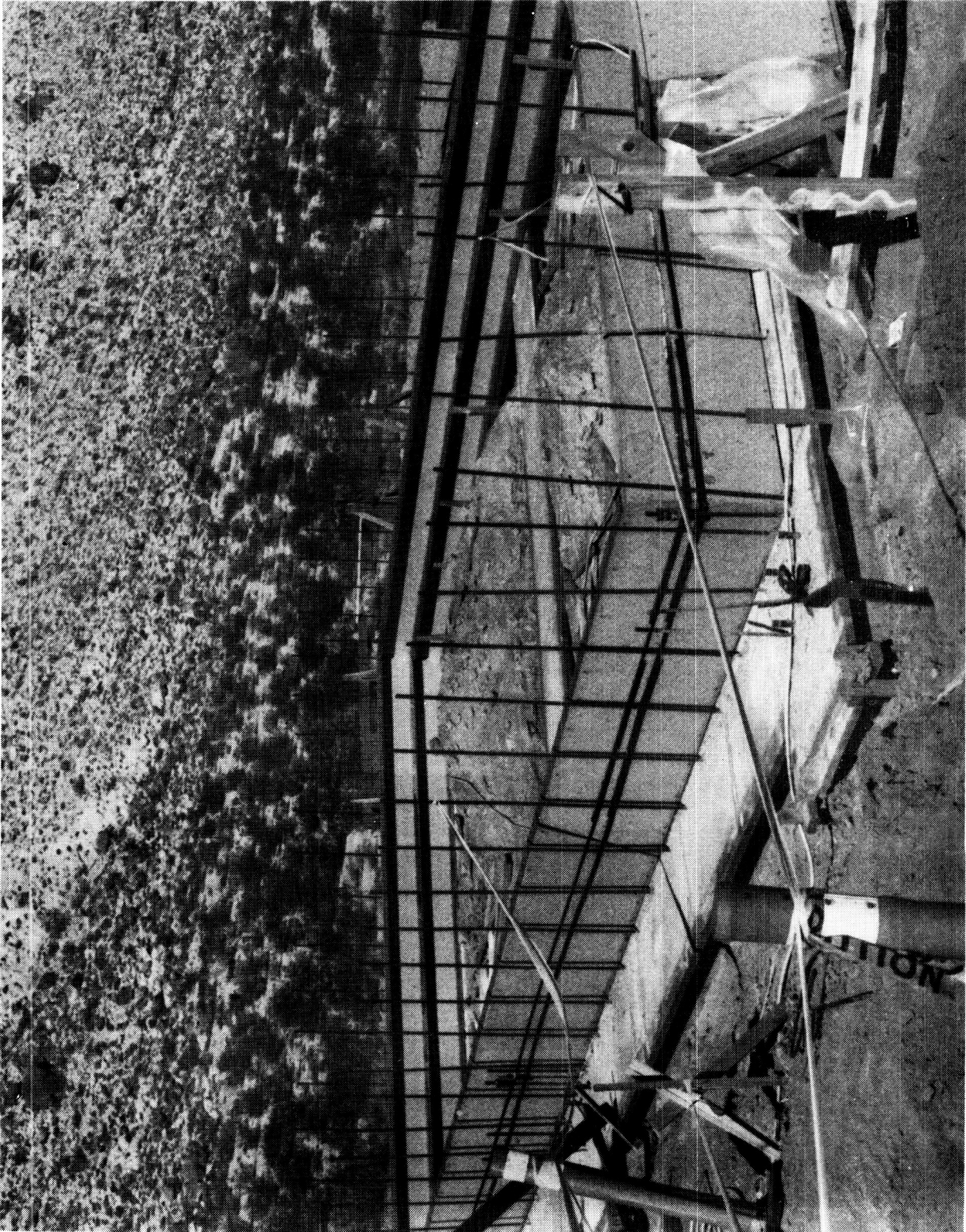


Figure 23. Venus Site: Setting of Forms for Sills and Installation of Rebars for Walls at Storage Facility

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Figure 24. Echo Site: Erection of Structural Steel for Storage Facility

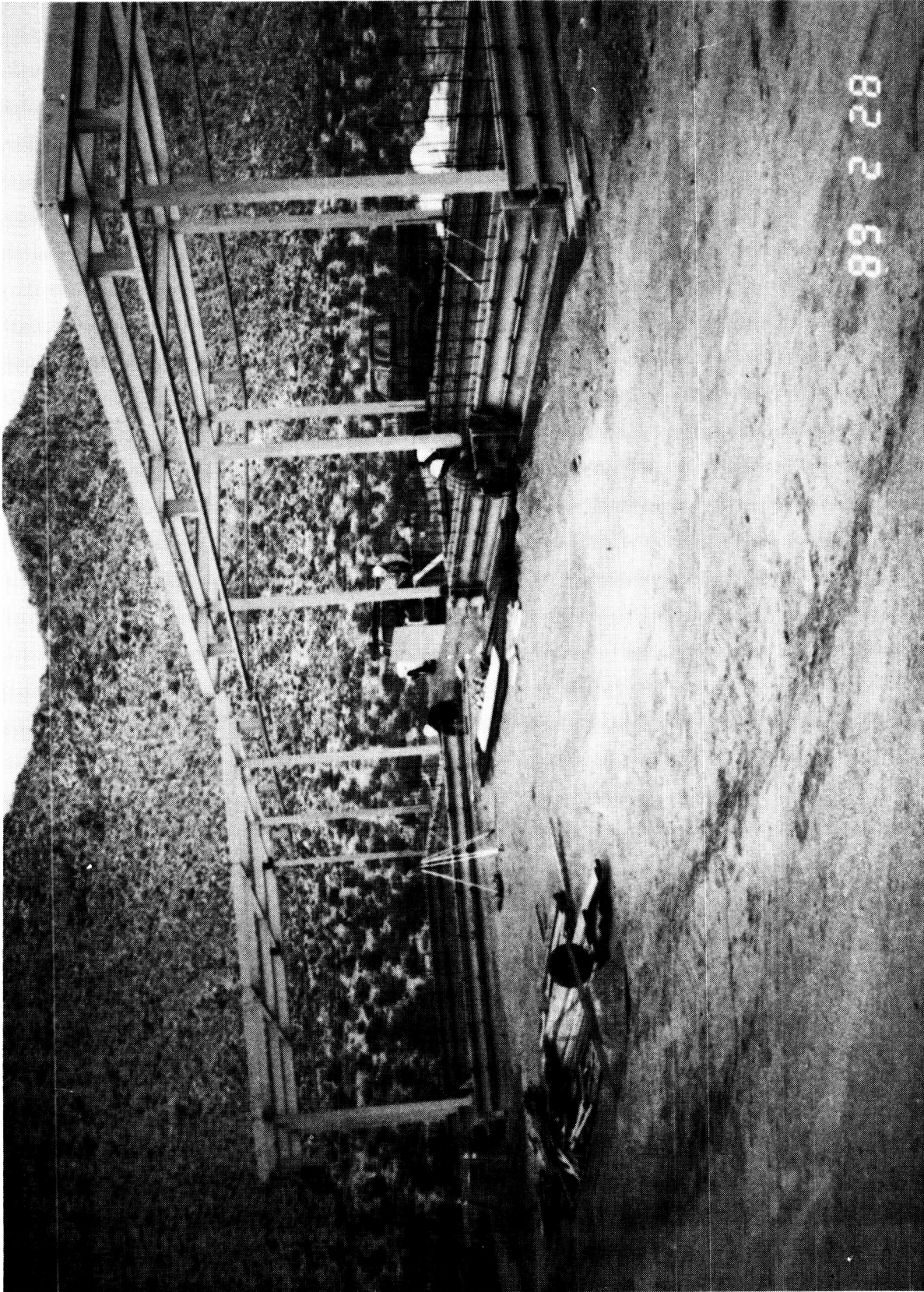


Figure 25. Venus Site: Erection of Structural Steel of Storage Facility (background)
and Acid-Wash Facility (foreground)

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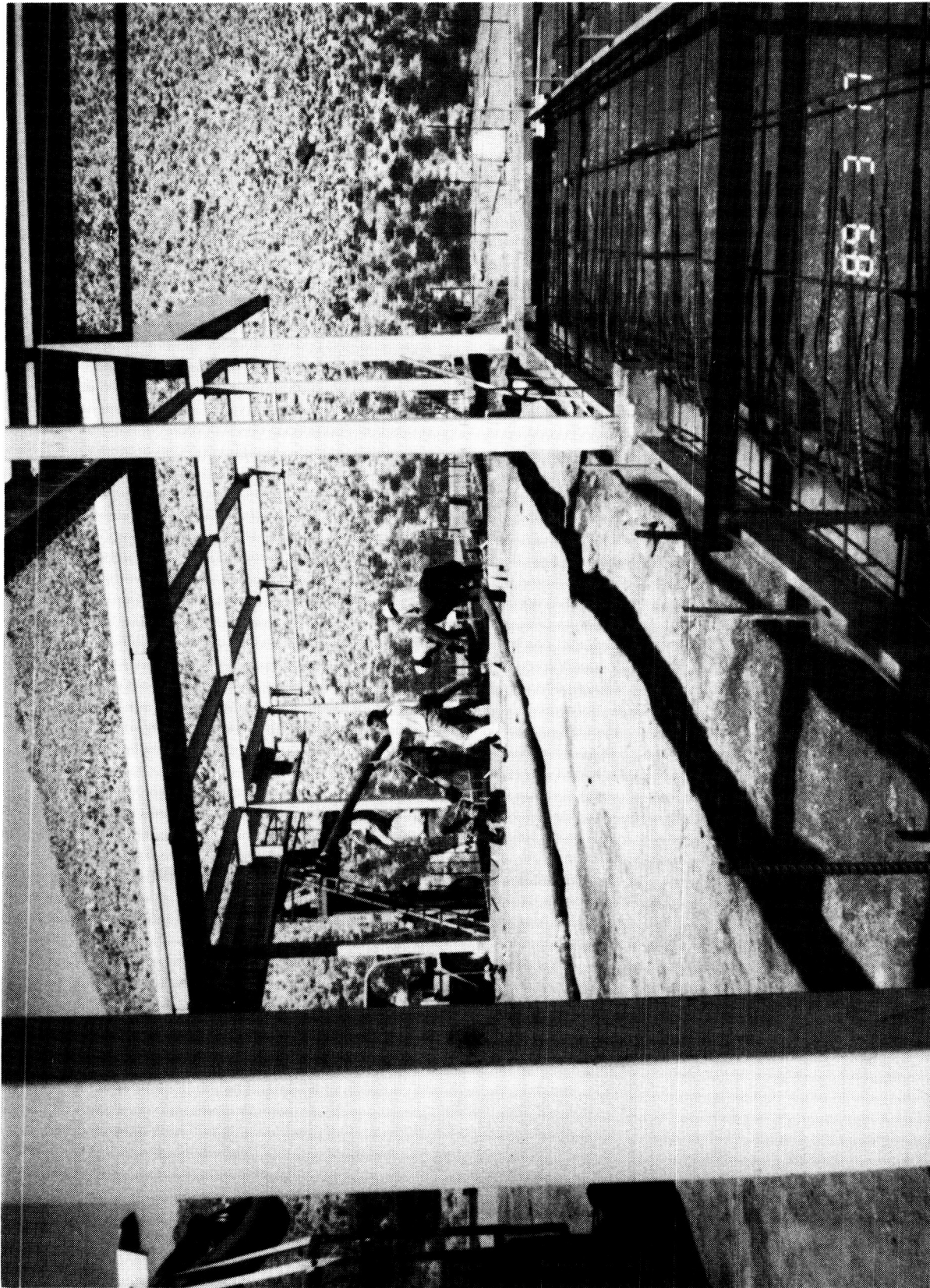


Figure 26. Venus Site: Pouring of Concrete Floor Slab of Storage Facility (background) while Preparation for Concrete Pouring of Floor Slab of Acid-Wash Facility is Visible in Foreground

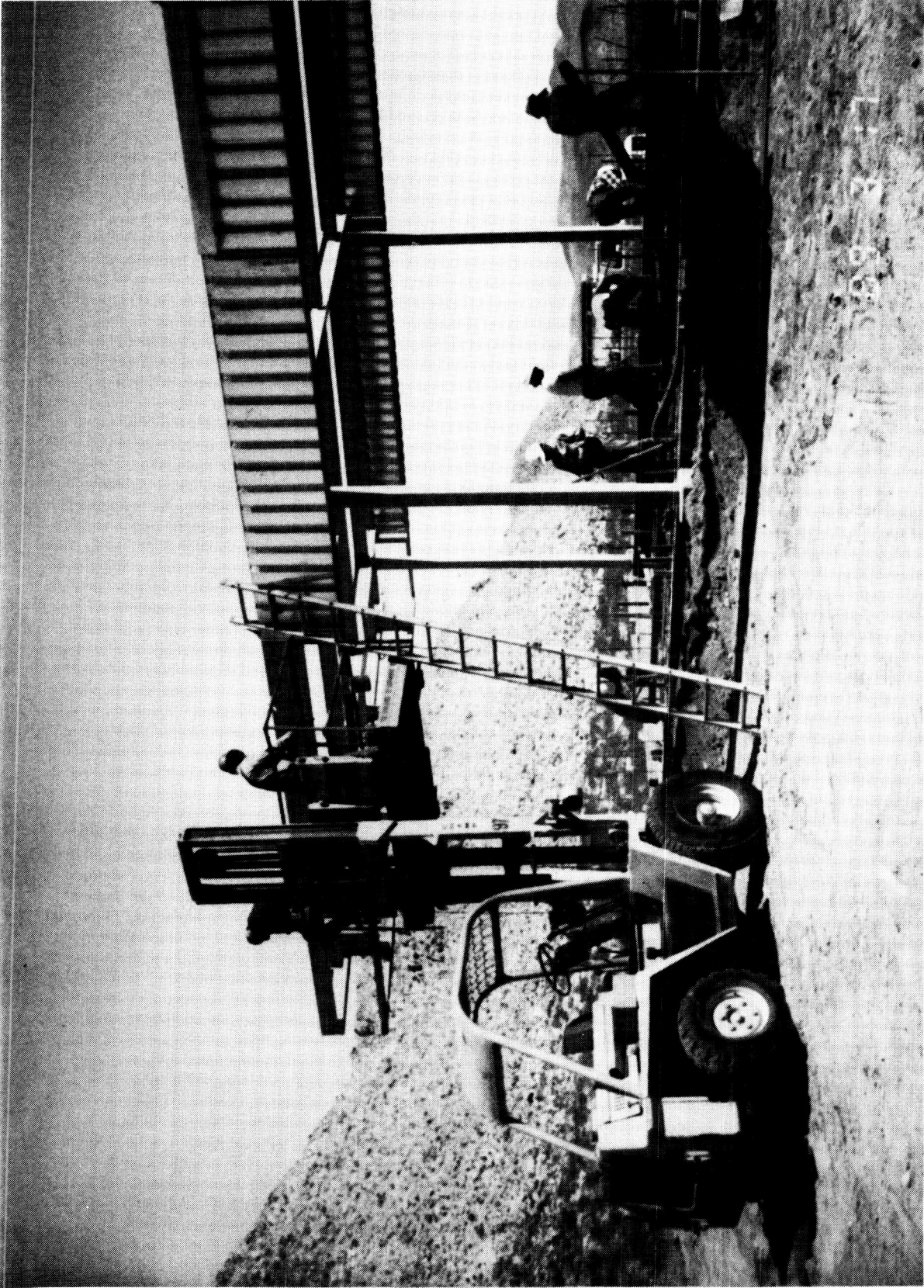


Figure 27. Venus Site: Attachment of Sheet-Metal Facings to Roof of Storage and Acid-Wash Facilities

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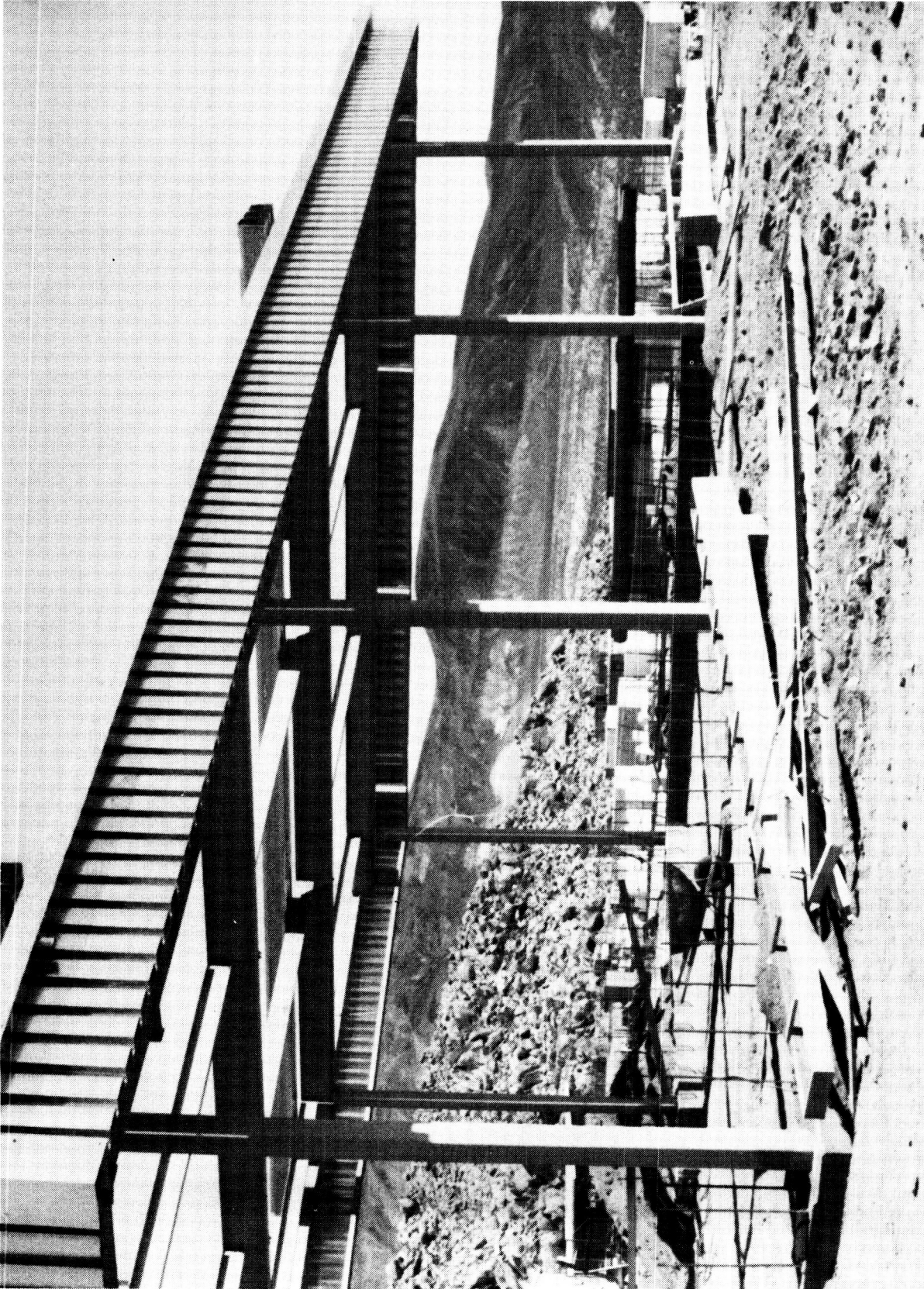


Figure 28. Venus Site: Completed Attachment of Sheet-Metal Facings to Roofs of Storage and Acid-Wash Facilities

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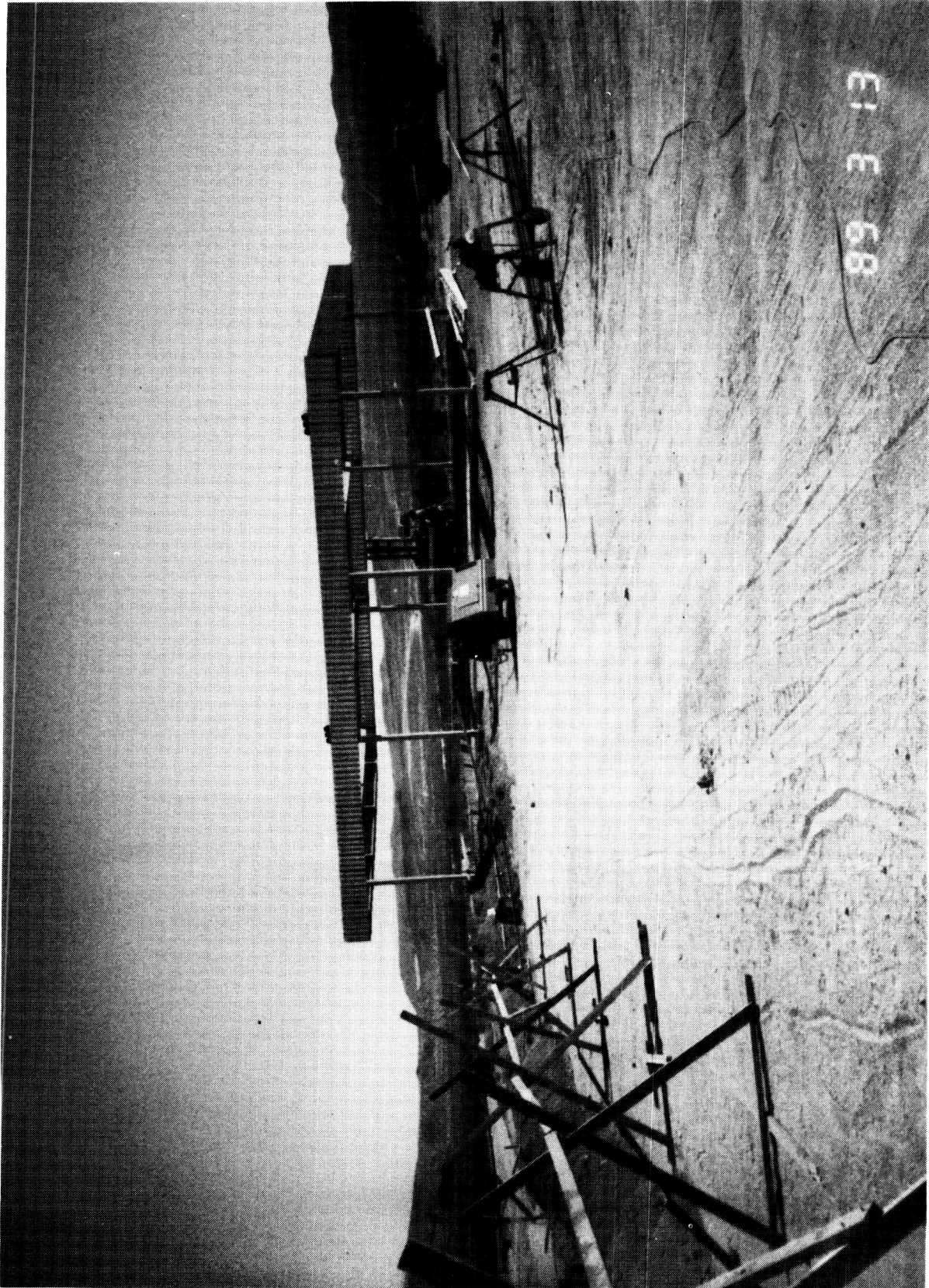


Figure 29. Echo Site: Looking South. Attachment of Sheet-Metal Facings to Roof of Storage Facility. Note Trenching for Utility Conduits



Figure 30. Echo Site: Looking Northwest. Attachment of Sheet-Metal Facings to Roof of Storage Facility

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Figure 31. Echo Site: Completed Attachment of Roof and Sheet-Metal Facings to Storage Facility. Masonry Blocks Ready to Form Walls

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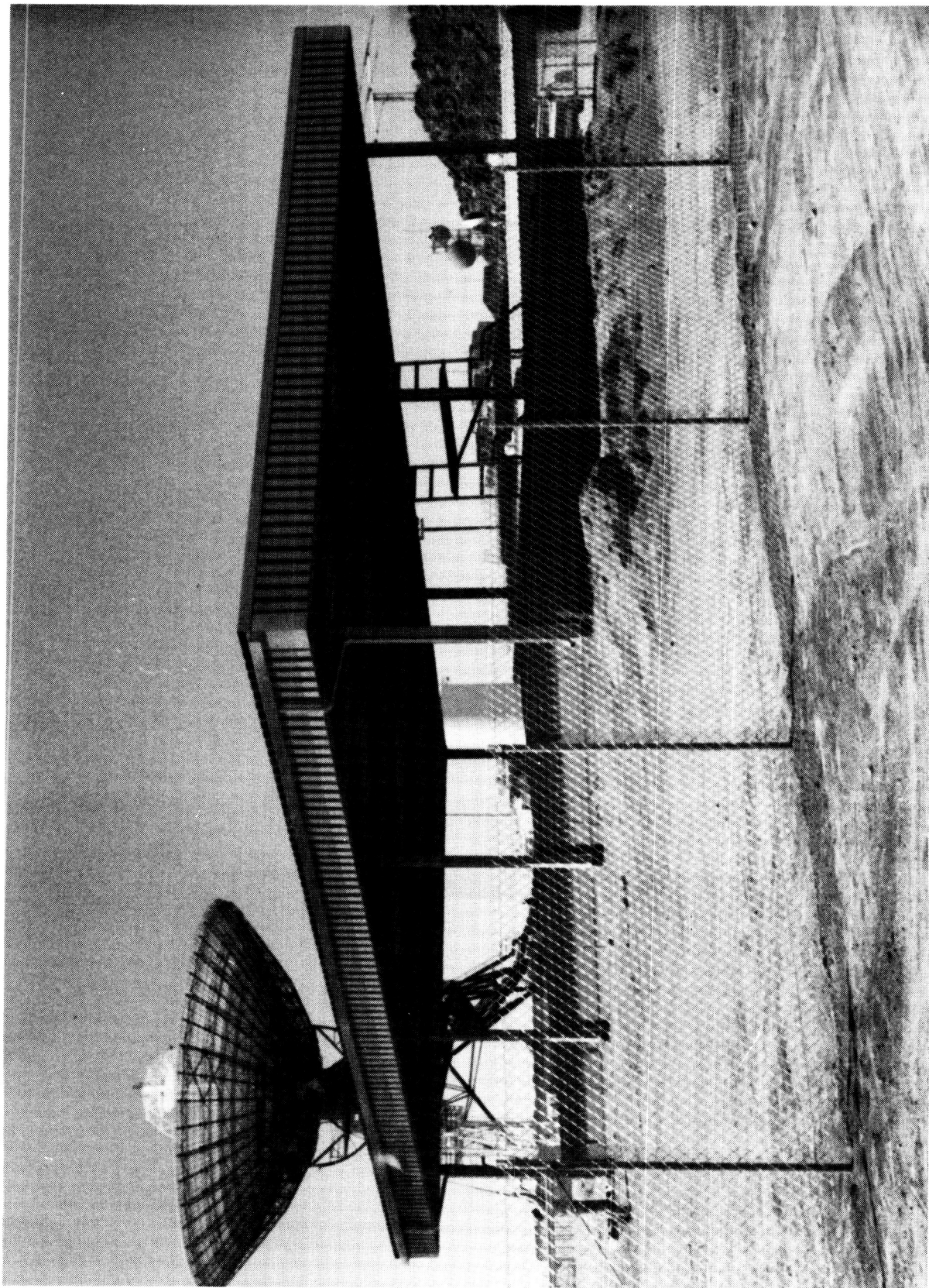


Figure 32. Echo Site: Partially Completed and Painted Structure for Storage Facility with Masonry Walls and Roof with its Gutters and Downspouts. Note Perimeter Chain-Link Fence

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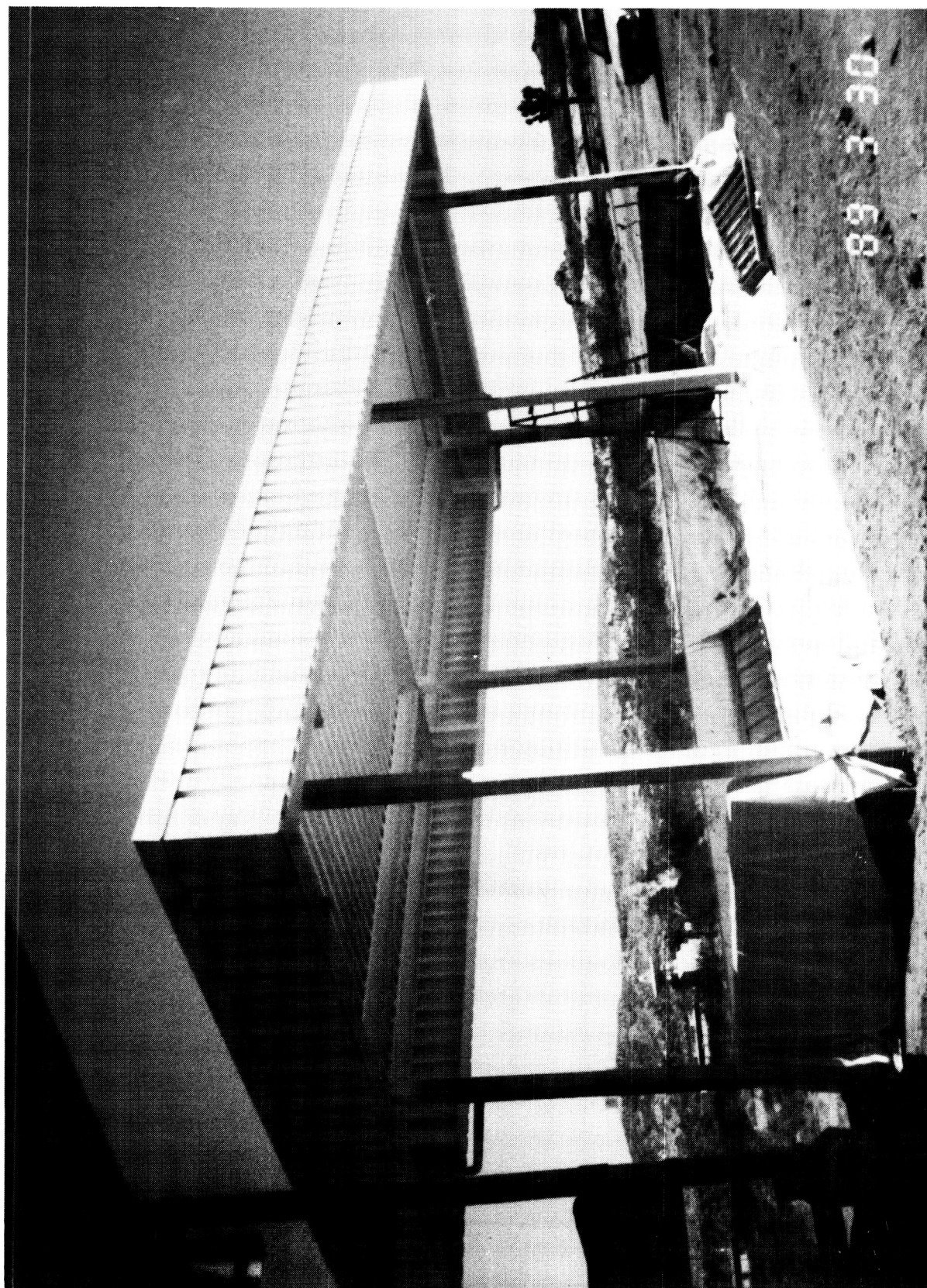


Figure 33. Venus Site: Completion of Structure of Acid-Wash Facility with Masonry Walls.
Completed Painting of Roof and its Supporting Beams and its Gutters and
Downspouts

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Figure 34. Echo Site: Initiation of Use of New Storage Facility for Hazardous Materials and Wastes with Storage of Hazardous-Waste Containers on Floor Pallets

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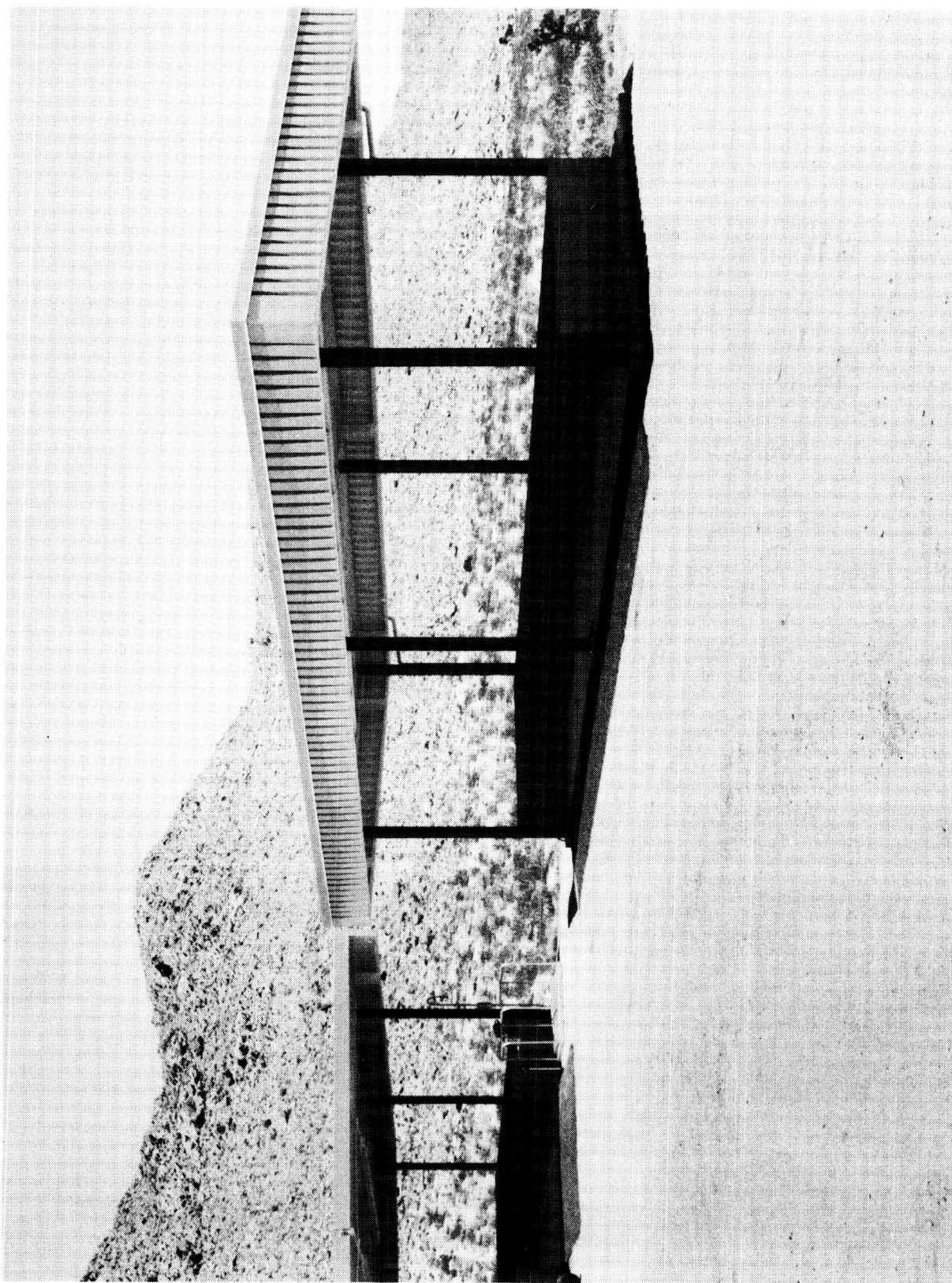


Figure 35. Venus Site: New, Completed Hazardous Materials Storage Facility (to Left) and New Acid-Wash Facility. Note Emergency Shower and Eye-Wash Facility.

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16. Abstract <p>The Goldstone Deep Space Communications Complex (GDSCC), located in the Mojave Desert about 40 miles north of Barstow, California, and about 160 miles northeast of Pasadena, is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network, one of the world's largest and most sensitive scientific telecommunications and radio navigation networks. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California. A detailed description of the GDSCC is presented in Section II of this report.</p> <p>Activities at the GDSCC are carried out in support of seven parabolic dish antennas. These activities may give rise to environmental hazards: use of hazardous chemicals, asbestos, and underground storage tanks have become so complex there is a need to devise specific programs to comply with the many regulations that implement these laws.</p> <p>In support of the national goal of the preservation of the environment and the protection of human health and safety, NASA, JPL and the GDSCC have adopted a position that their operating installations shall maintain a high level of compliance with these laws.</p> <p>Some hazardous materials, including various oils, kerosene, chlorinated solvents, and acids, are used in day-to-day operations at the GDSCC. Thus, as defined in the California Administrative Code, the GDSCC is a generator of hazardous wastes.</p>					
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